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MSS. intended for publication and books, etc., intended for review should be sent to the Editor of SCIENCE, Garrison-on-Hudson, N. Y.

UNIVERSITY REGISTRATION STATISTICS

THE registration returns for November 1, 1909, of twenty-eight of the leading universities of the country will be found tabulated on page 898. Three institutions have been added to the list this year, namely, Texas, Tulane and Washington (St. Louis). The introductory comments made last year on the relative value of the figures presented in the table[1] should be borne in mind in studying the statistics herewith submitted. May I point out once again, however, that I do not wish the reader to infer that in my opinion size is the primary consideration in examining an institution of learning; on the contrary, I am thoroughly convinced that there is as much fault to be found with an overgrown department, school or university as there is with an overgrown city or potato. We are concerned in the present instance, however, with values expressed merely in student units and not in terms of productive efficiency.

This year four institutions—Iowa, Minnesota, New York University and Yale—show a loss in enrollment compared with the previous year, as against two in 1908 and five in 1907. On the whole, considerable gains have been made all along the line, the increase in several instances being quite marked. The greatest gains in terms of student units, including the summer session attendance, have been made during the year by Columbia, Chicago, Wisconsin, California, Cornell, Ohio and Pennsylvania, in the order named, each one of

[1] SCIENCE, N. S., Vol. XXVIII., December 25, 1908, p. 911.

Faculties November 1, 1909	California	Chicago	Columbia	Cornell	Harvard (incl. Radcliffe)	Illinois	Indiana	Iowa	Johns Hopkins	Kansas	Michigan	Minnesota	Missouri	Nebraska	New York	Northwestern	Ohio State	Pennsylvania	Princeton	Stanford	Syracuse	Texas	Tulane	Virginia	Washington	Western Reserve	Wisconsin	Yale
College Arts, Men	533	794	632	} 950	2256	400	503	521	158	526	1116	613	491	482	340	390	375	368	894	540	} 1310	497	91	328	79	321	744	1238
College Arts, Women	995	670	513		464	465	428	522	.....	530	654	953	459	472	158	557	359	.....	.....	456		476	181	.....	139	297	873	.....
Scientific Schools*	802	.....	666	1727	96	1087	.....	201	.....	432	1291	590	548	523	210	58	857	807	370	475	400	230	145	105	162	.....	783	968
Law	112	199	318	256	760	168	131	235	378	204	760	376	249	170	768	261	180	344	.....	42	189	314	64	256	94	139	149	348
Medicine	60	146	307	178	312	512	244	218	174	83	354	176	30	110	472	571	.....	542	.....	7	139	206	423	86	190	92	48	125
Non-Professional Grad. Schools	337	441	797	256	423	230	111	121	.....	70	151	93	122	97	264	82	76	389	134	84	55	.....	24	28	24	24	259	413
Agriculture	171	.....	.....	509	.....	551	.....	.....	.....	.....	.....	681	275	390	.....	.....	284	.....	.....	.....	.....	.....	.....	.....	.....	.....	310	.....
Architecture	†	.....	128	140	.....	240	.....	.....	.....	.....	†	.....	.....	.....	.....	.....	36	191	.....	.....	62	.....	13	.....	19	.....	.....	.....
Art	116	.....	.....	.....	.....	1	.....	†	.....	39	.....	.....	.....	61	.....	.....	.....	.....	.....	.....	124	.....	79	.....	184	.....	.....	49
Commerce	213	.....	.....	.....	73	133	.....	†	.....	.....	†	.....	.....	.....	868	300	.....	487	.....	.....	.....	.....	.....	.....	.....	.....	238	.....
Dentistry	57	.....	.....	.....	86	107	.....	155	.....	.....	212	196	.....	.....	.....	308	.....	434	.....	.....	.....	.....	89	.....	93	87	.....	.....
Divinity	.....	174	.....	.....	48	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	216	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	109
Forestry	†	.....	.....	.....	†	†	.....	.....	.....	.....	†	98	.....	38	.....	.....	28	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	83
Journalism	.....	.....	.....	.....	.....	13	.....	.....	.....	.....	†	.....	65	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Music	†	.....	25	.....	.....	55	.....	37	.....	124	.....	†	.....	475	.....	382	.....	29	.....	.....	758	.....	39	.....	.....	.....	108	75
Pedagogy	†	184	974	.....	.....	†	.....	†	.....	.....	†	69	220	316	441	.....	48	541	.....	.....	80	280	27	.....	.....	.....	.....	.....
Pharmacy	78	.....	290	.....	.....	173	.....	53	.....	70	93	81	.....	15	.....	217	75	.....	.....	.....	.....	61	8	.....	.....	71	37	.....
Veterinary Medicine	.....	.....	.....	98	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12	.....	202	168	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Other Courses	.....	394	.....	405	.....	38	.....	55	.....	.....	.....	110	.....	.....	.....	130	137	325	.....	.....	103	29	47	.....	19	63	48	.....
Deduct Double Registration	*20*	*198*	.....	*5*	.....	.....	.....	*94*	.....	*156*	.....	.....	*233*	*28*	*109*	*343*	*13*	*20*	.....	.....	*82*	*298*	*74*	*36*	.....	*11*	*102*	*144*
Total	3454	2804	4650	4514	4518	4173	1417	2024	710	1922	4631	4036	2226	3121	3424	3129	2644	4608	1398	1604	3138	1795	1156	767	1003	1083	3495	3264
Summer Session 1909	819	3253	1968	889	1377	631	1139	361	.....	368	1225	452	552	402	563	244	642	449	.....	59	203	848	782	.....	.....	.....	1133	12
Deduct Double Registration	*189*	*570*	*486*	*375*	*337*	*302*	*325*	*139*	.....	*146*	*597*	*137*	*189*	*121*	*144*	*176*	*274*	*200*	.....	*43*	*93*	*151*	*56*	.....	.....	.....	*383*	.....
Grand Total 1909	4084	5487	6132	5028	5558	4502	2231	2246	710	2144	5259	4351	2589	3402	3843	3197	3012	4857	1398	1620	3248	2492	1882	767	1003	1083	4245	3276
" " 1908	3751	5114	5675	4700	5342	4400	2113	2356	698	2086	5188	4607	2558	3154	3951	3113	2700	4555	1314	1541	3204	1446	1171	757	.....	1016	3876	3466
" " 1907	3346	4594	5197	4293	5346	4172	1667	2188	651	1932	4953	4207	2274	2812	3648	2714	2344	4134	1311	1594	3162	1474	1219	757	.....	914	3401	3435
" " 1906	3246	4731	4650	4075	5343	3810	1515	1950	618	1690	4674	3944	2071	2807	3283	2635	2180	3934	1352	1530	3004	1351	1285	745	.....	905	3099	3477
" " 1905	3631	4557	4755	3871	5283	3635	1377	1700	688	1706	4521	3940	1887	2635	2912	2791	2057	3430	1361	1606	2776	1190	838	696	.....	856	3083	3477
" " 1904	3738	4035	4833	3833	5392	3369	1206	1460	740	1446	4000	3886	1704	2728	2380	2856	1758	3027	1385	1424	2452	930	1124	691	.....	808	3370	3008
" " 1903	3690	4146	4557	3438	6013	3239	1614	1260	694	1319	3926	3550	1540	2513	2177	2740	1710	2644	1434	1370	2207	785	1037	638	.....	765	3221	2990
Extension and Similar Courses	700	‡	2250	.....	920	.....	.....	.....	67	257	.....	140	95	350	525	31	.....	.....	.....	.....	.....	142	40	.....	40	62	3162	.....
Officers	322	330	687	585	612	545	100	160	214	137	466	239	189	259	295	351	224	483	185	150	240	129	204	96	142	231	439	401

* Includes schools of mines, engineering, chemistry and related subjects

† Included elsewhere. ‡ No figures furnished

NOTE.—The Texas and Tulane figures for 1903–1908 are exclusive of the summer session

these having gained over three hundred students. Columbia was the only institution to register an increase of over four hundred students this year, whereas there were no less than eight last year. Omitting the summer session, the largest gains have been made by Pennsylvania, Cornell, Wisconsin, California, Ohio and Nebraska, in the order given, the growth in each case being one of two hundred students or more. Comparing this year's grand totals with those of 1902, we find that the largest gains during this period have been made by Pennsylvania, Columbia, Cornell, Illinois, New York University, Michigan, Ohio, Wisconsin, Syracuse, Chicago and Missouri, each of these universities showing an increase of over one thousand students. It will be observed that these institutions are fairly evenly divided between the east and the west, but that the first three are all eastern institutions, although it is ordinarily supposed that, speaking broadly, the western institutions have been growing much more rapidly than the eastern institutions during the past decade and at the expense of the latter.

According to the figures for 1908, the twenty-five universities included in the table ranked as follows: Columbia, Harvard, Michigan, Chicago, Cornell, Minnesota, Pennsylvania, Illinois, New York University, Wisconsin, California, Yale, Syracuse, Nebraska, Northwestern, Ohio, Missouri, Iowa, Indiana, Kansas, Stanford, Princeton, Western Reserve, Virginia, Johns Hopkins. Comparing this with the order for 1909, we observe that Chicago and Michigan have changed places, that Pennsylvania and Illinois have passed Minnesota, that Wisconsin and California have passed New York University and that Yale and Syracuse have been passed by Nebraska. For the second time in the history of American higher institutions of learning the six thousand mark has been exceeded, Columbia having a total enrollment this year of 6,132, Harvard having registered 6,013 students in 1903. Cornell is the fifth institution to pass the five thousand mark, its total registration this year being 5,028; Harvard passed it a number of years ago, Columbia in 1907 and Chicago and Michigan last year. Omitting the summer session enrollment, the order is naturally somewhat different, namely, Columbia, Michigan, Pennsylvania, Harvard, Cornell, Illinois, Minnesota, Wisconsin, California, New York University, Yale, Syracuse, Northwestern, Nebraska, Chicago, Ohio, Missouri, Iowa, Kansas, Texas, Stanford, Indiana, Princeton, Tulane, Western Reserve, Washington, Virginia, Johns Hopkins—the order being quite different from that of last year, most notable being the change of position between Columbia and Michigan and the passing by Pennsylvania of Minnesota, Harvard and Cornell; Illinois has also passed Minnesota, while Wisconsin and California have passed New York University.

Considering the various faculties in order, we find that, with a few exceptions, notably Northwestern and Wisconsin, there have been gains all along the line in the attendance on the male undergraduate academic departments, the most important increases being shown by Princeton, Nebraska, Stanford and Kansas. The gain in the case of Princeton, however, is evidently due in great measure to a readjustment of terminology. The enrollment of undergraduate women also shows a satisfactory general increase, the gain being most marked in the case of California, Wisconsin, Radcliffe and Northwestern. At California, Illinois, Iowa, Kansas, Minnesota, Northwestern, Tulane, Washington and Wisconsin, and probably at Cornell

and Syracuse, the number of the undergraduate women is larger than that of the men. Harvard continues to lead in the number of male academic students, being followed by Yale, Princeton, Michigan, Chicago, Wisconsin, Columbia and Minnesota; including the women, the order would be Harvard, Michigan, Wisconsin, Minnesota, California, Chicago, Syracuse, Yale, Columbia, Kansas and Iowa, each of these institutions enrolling over one thousand academic students.

A general depression is noticeable in the case of the engineering schools, Stanford being the only institution to exhibit a noteworthy gain, the increase in the case of Illinois, Syracuse, Virginia and Yale being insignificant, Cornell remaining stationary, and every one of the other institutions showing a loss, which in the case of several is quite marked. At Columbia there has been a gain of ten per cent. in new students, which, however, was not large enough to offset the loss of old students occasioned primarily by increased standards for advancement. Cornell continues to maintain its lead in the number of scientific students, Michigan and Illinois being the only other institutions to attract over one thousand students to their schools of engineering; these are followed by Yale, Ohio, Pennsylvania, California, Wisconsin, Columbia, Minnesota, Missouri and Nebraska, each of these universities attracting over five hundred students to their scientific schools.

Thirteen of the medical schools and ten of the law schools exhibit a loss as against last year, while nine of the medical schools and twelve of the law schools have experienced an increase in attendance, there being a total loss of 185 students in medicine and of 79 students in law since last year at the institutions included in both this and last year's tables. The largest gains in medicine have been registered by New York University and Northwestern, in law by Harvard, Ohio and Michigan; the largest losses in the former have been experienced by Michigan and Iowa, in the latter by Minnesota and Yale. The eastern institutions show a loss of three students in medicine and of eight students in law, whereas the western institutions lost 182 in medicine and 71 in law. New York University still attracts the largest number of law students, being followed by Harvard and Michigan, Minnesota, Yale, Pennsylvania, Columbia and Texas, each of these having an enrollment of over three hundred students. In medicine Northwestern has passed Pennsylvania, these being followed by Illinois, New York University, Tulane, Johns Hopkins, Michigan, Harvard and Columbia, all of these institutions enrolling more than three hundred students.

The graduate schools experienced an increase of 393 students, Harvard being the only institution on the list to show a loss of any moment, the largest gains having been made by Northwestern, Indiana and Columbia. The last named institution, with an enrollment of 991 students (to the 797 in the table should be added 194 graduate students at Teachers College, who are omitted here for the sake of avoiding the item of double registration), has by far the largest graduate school, being followed by Chicago, Harvard, Yale, Pennsylvania, California, New York University, Wisconsin, Cornell and Illinois, each of these institutions enrolling over two hundred non-professional graduate students. It will be observed that six of these institutions are in the east and four in the west.

All of the schools of agriculture show a most encouraging increase, the single exception being Minnesota, where the apparent decrease of 348 is undoubtedly due to the fact that the students enrolled in the

short course were included last year but omitted this year. In spite of this fact, Minnesota remains at the head of the list so far as attendance is concerned, being followed by Illinois and Cornell, as last year.—Illinois, Pennsylvania and Cornell exhibit gains in architectural students, in the order named, while Columbia and Syracuse have remained stationary. The four largest schools are those of Illinois, Pennsylvania, Cornell and Columbia.—Northwestern, California, Pennsylvania and Harvard have registered an increase in their schools of commerce, Illinois and New York University showing a very slight loss. The last named institution and Pennsylvania maintain the largest schools.—The dental schools, which last year for the most part suffered a loss, have made encouraging advances, Iowa being the sole exception, and the decrease in her case is slight. Northwestern and Pennsylvania registered the largest gains. From the standpoint of attendance on the dental schools the universities rank in the order Pennsylvania, Northwestern, Michigan, Minnesota.—Only four of the institutions on the list, that is, only one seventh, support divinity schools, the eastern universities, Harvard and Yale, showing a gain, the western universities, Chicago and Northwestern, a loss. The latter institution has the largest attendance on this particular faculty.—The forestry students are in several instances not listed separately; wherever they are, an increase is apparent, except at Ohio, the loss there being a small one.—Nebraska, Northwestern and Syracuse attract the largest number of students of music, and are the only institutions that registered an increase in this department, Columbia's attendance having remained stationary.—Missouri, New York University and Syracuse have fewer students of pedagogy than they had last year, the Teachers College of Columbia University leading in enrollment, with Pennsylvania, New York University, Nebraska, Texas and Missouri following in the order given. The 544 students mentioned under pedagogy at the University of Pennsylvania are enrolled in courses for teachers.—Northwestern, California, Columbia and Nebraska have made gains in pharmacy, Wisconsin has remained stationary and all of the other institutions show losses in this field. Columbia continues to maintain the largest school of pharmacy and Northwestern has passed Illinois.—Ohio, Pennsylvania and Cornell attract the largest number of students of veterinary medicine and all three have made slight gains, New York University having remained to all intents and purposes stationary.

Two thirds of the institutions experienced an increase in their summer session enrollment, the most significant gains having been secured by Columbia and Chicago. The latter attracted over three thousand students to its summer quarter, Columbia drew almost two thousand to its summer session, and Harvard, Michigan, Indiana and Wisconsin all had over one thousand students. The Columbia figures are exclusive of students registered at Camp Columbia, Morris, Conn., for summer work in surveying or geodesy. In connection with the summer session it must be borne in mind that all of the summer students are not of college grade, but no detailed figures on this point are available.

The New England colleges for women have fared better than those for men and those for both sexes, Smith, Wellesley and Mt. Holyoke all showing gains over last year, whereas Dartmouth, Brown, the University of Maine, Amherst, Tufts (college only) and Bowdoin show losses, the Massachusetts Institute of Technology, Wesleyan and Williams having registered an increase

over last year. Vassar and Bryn Mawr, Lehigh and Lafayette and Oberlin (college only) also exhibit a gain in attendance, while Purdue and Haverford show a slight loss. All of the institutions just mentioned, with the exception of Brown, Bryn Mawr and the Massachusetts Institute of Technology, show an increase as compared with five years ago, the figures in detail being as follows:

Institution	1909	1908	1904
Amherst	526	528	412
Bowdoin	419	420	363
Brown	974	993	988
Bryn Mawr	412	393	441
Dartmouth	1,197	1,133	926
Haverford	157	160	146
Lafayette	468	455	422
Lehigh	667	662	609
Massachusetts Inst. of Tech.	1,480	1,462	1,561
Mount Holyoke	752	748	674
Oberlin (college only)	953	855	652
Purdue	1,682	1,717	1,359
Smith	1,609	1,566	1,067
Tufts (college only)	428	434	375
University of Maine	850	884	563
Vassar	1,039	1,014	979
Wellesley	1,319	1,282	1,050
Wesleyan	343	322	305
Williams	528	487	443

The falling off in the number of undergraduates at Brown may be attributed to increased entrance requirements demanded of candidates for engineering degrees. Of the 1,197 students enrolled at Darmouth, 1,112 are in the college, 57 in the medical school, 50 in the Thayer school and 35 in the Tuck school. At Oberlin the total registration, including in addition to the college the theological seminary, the conservatory of music, the academy and the students in drawing and painting, is 1,798, as against 1,748 in 1908 and 1,505 in 1904. The Purdue figures represent the total registration in the four classes in the schools of agriculture, chemical engineering, civil engineering, electrical engineering, mechanical engineering and science, the two classes in the school of pharmacy, together with special and graduate students in the university as a whole; no entry is made for the agricultural winter course, since this does not open until January. At Tufts the medical and dental schools show an attendance of 717, a gain of 36 over last year and of 108 over 1904, the total attendance for the three years in question being 1,145, 1,115 and 1,004, respectively. The slight decrease in enrollment at the University of Maine is probably due to increased standards of admission and to the increase in tuition for students who come from outside the state of Maine. At Vassar an effort is made to keep the total number down to approximately a thousand. The excess this year is owing to the fact that an unusually large number of former students returned in September, while the falling off among the new students was smaller than usual during the summer. At Wesleyan the chief gain has been experienced in the freshman class, which is the largest in the history of the college. There has been a total gain of 21 students, in spite of the fact that a considerable number of the women students left this year by reason of the recent action of the trustees abolishing coeducation; there are at present only 19 women students enrolled.

Taking up the various institutions in alphabetical order, we find that the *University of California* shows gains in every department with the exception of engineering, the most substantial increase being found in the number of undergraduate women, namely, one of 116 students. Of the 337 students in the graduate school about 160 are women, most of whom are candidates for the teacher's recommendation. The graduate school also includes 14 candidates for the degree of *juris doctor,* which is conferred two years after the A.B. or the LL.B.

The *University of Chicago* shows a substantial gain in its grand total, the chief increase having taken place in the summer quarter. In the present quarter the largest gains have been made in the courses given for teachers, listed under "other courses," and in the male college department. The graduate school also shows a healthy gain, while divinity, law and medicine experienced slight losses, pedagogy having remained stationary and the registration under "college of arts, women," having fallen off from 685 to 670.

Columbia University shows a large increase in its grand total and a gain of 110 students in its fall enrollment, gains in the number of academic undergraduates, in the graduate schools and at Teachers College more than offsetting slight losses elsewhere. The attendance on the schools of law and medicine has remained stationary. The summer session experienced the encouraging increase of 436 students.

Cornell University shows a healthy increase both in the fall enrollment and the summer session, the increase in the grand total being one of 328 students. The medical school alone shows a loss in attendance, the scientific schools having remained stationary. Of the 1,727 students in the latter department, 1,167 are registered in mechanical and 560 in civil engineering. Of the medical students 160 are in New York and 18 in Ithaca. The students listed under "other courses" are enrolled in the short winter course in agriculture, there being a total gain of 162 students in this and the regular agricultural course.

Harvard University also experienced an increase in its summer as well as its fall registration, the only losses in attendance occurring in the scientific schools, the graduate school and the medical school. Of the 96 scientific students, 83 are registered in the graduate school of applied science and the remainder in the Lawrence scientific school. The Lowell Institute, in cooperation with Harvard University, offers free courses of lectures corresponding closely in subject matter, methods of instruction, examinations and scale of marking, with those given in Harvard College. These courses, when accepted by the appropriate departments of the faculty of arts and sciences, may be counted towards a degree by men who afterwards secure admission to Harvard College. Nine hundred and twenty persons are now registered in these courses. About five of this number are now registered in Harvard University. The opportunities offered by these courses of lectures now make it unnecessary for the university to maintain the afternoon and Saturday courses for teachers, which it has been accustomed to offer in the last two years.

The *University of Illinois* gained 121 students this fall, but lost 25 in the summer. The chief increase this fall is to be found in the schools of agriculture and architecture and in the number of undergraduate women. Losses have been experienced in music and pharmacy, the other faculties having remained practically stationary. The marked increase in the number of agricultural students is said to be the natural result of the growing appreciation of the value of scientific knowledge on the part of the farmers. It is difficult to predict whether the increase in architecture is sporadic or likely to be permanent. The losses in music and in pharmacy are due to increased requirements.

Indiana University registered an increase of 134 in its summer session and one of 50 in the fall enrollment, losses in medical and male college students being more than offset by gains in the other faculties, an increase of 71 students in the graduate school being especially noteworthy. The

last mentioned gain, however, is in all probability due to a change in classification and does not represent an actual growth of that size in graduate students.

The *State University of Iowa,* which last year exhibited an increase in every department but dentistry, has lost 98 students this fall, the summer session having remained stationary. The chief losses have been experienced in medicine, music and engineering. The 55 students listed under "other courses" are registered in the nurses' training school. The most noticeable change in enrollment is the loss in numbers in the college of medicine. This is due to an advance in the requirement for admission from the completion of four years of high school work to the completion of one year of college work. In 1910 the requirement for admission to the college of medicine will be two years of college work. The requirement for admission to the college of dentistry was advanced from the completion of three years of high school work to the completion of four years of high school work. The loss on this account, however, was slight.

Johns Hopkins University has gained 12 students since last year, an increase of 23 students in medicine being diminished by a loss of 8 college and 3 graduate students. Forty-five students are enrolled in the special courses for physicians and 67 in the college courses for teachers given afternoons and Saturday mornings.

The *University of Kansas* lost a few students in the summer, but gained 56 this fall, the gain in the grand total being one of 58, there being a decrease in the number of summer session students who returned for work this fall. There is a large gain in the attendance of male academic students, while the engineering schools have not increased in numbers. The most marked increase in attendance is found in the graduate school. In spite of the fact that two years of college are now required for admission to the medical school, the first-year class shows a healthy increase in attendance.

The gain of 71 students in the grand total attendance of the *University of Michigan* is to be laid at the door of its summer session, which showed an increase of 139 students, as against a loss of 5 in the fall enrollment, gains in male undergraduates, law and dentistry not quite offsetting losses in medicine, engineering, pharmacy and the graduate school. Mr. Arthur G. Hall, registrar, writes as follows:

> Including the graduate students registered in the summer session, but making due allowance for duplications, there were altogether 270 graduate students registered prior to November 1. The figures given for law are exclusive of 35 students and those for medicine of 37 students registered in the "combined course." The department of law has a larger number of students than ever before. As was foreseen, the raising of the requirements for admission to the department of medicine and surgery to two full years of the arts course, has resulted in a falling off in the size of the entering class. The combined arts-medical and arts-law courses continue to grow in favor, as does the course in forestry. The dental college is fully settled in its new building. In spite of the higher admission requirements which went into effect this year, this college shows a ten per-cent. increase in enrollment. The summer session of 1909 was more largely attended than the session of any previous year, the total registration being 1,225. This was a gain of 148 over the session of 1908, or an increase of fourteen per cent.

Mr. E. B. Pierce, registrar, has furnished the following report for the *University of Minnesota:*

> The only decrease in attendance that is of any importance is in the college of medicine and surgery and in the college of law. The decrease in the college of law is due to the increased entrance requirement. All students entering that department now are required to complete one full year of work in the college of arts, and in 1911 two full years in the college of arts will be re-

quired for admission. Last year the total registration in law was 614. This year it is 376. The increase of 131 in the freshman class of the college arts is undoubtedly directly related to this increase in the entrance requirements for admission to law.

In 1908–9 the registration in the college of medicine and surgery was considerably increased by the amalgamation of the Hamline University medical department with that of the University of Minnesota, reaching 253. This year the registration has fallen to 176, due partly to the graduation of a number of the transferred Hamline students, and partly to the fact that the number who would naturally enter the freshman class of the Hamline medical department direct from the high school would be required to complete two years of college work in arts before gaining admission to the freshman medical class here.

The college of engineering shows a decrease in registration of 75, probably due to the lengthening of the course from four to five years. There are 612 students enrolled in the school of agriculture at the present time. While this school is not doing work of college grade, it is, on the other hand, not in any sense a preparatory school, but offers a three-year technical course. The registration figures for the short courses in agriculture, such as the teachers' summer school, the summer forestry school, the farmers' short course and the dairy school, amounting last year to 485, can not be given at this time.

The registration at the *University of Missouri* shows a slight increase over last year, but the gain is due almost entirely to the summer session. The fact that the regular session fails to maintain the rate of increase of preceding sessions is due to a number of causes. Chief among these is the establishment of tuition fees in the schools of law, medicine, engineering and journalism and for non-residents in all departments. The registration in individual departments has also been affected by regulations adopted for the reduction of double registration which has been reduced one half, and will be still further reduced during next session. As noted, last year the registration in the school of medicine was affected by uncertainty regarding plans for removing the last two years of the course to St. Louis or Kansas City. It was finally decided to discontinue temporarily the work of these years. The decrease in the school of education is only an apparent one, being due to the fact that beginning with this session two years of college work are required for admission to this school. The college of agriculture continues to show the largest increase in registration.

The *University of Nebraska* shows a gain of 200 in the fall enrollment and of 54 in the summer session. There has been a large increase (193) in the male academic department, apparently at the expense of the scientific schools (— 107), but this is due to the fact that the "general scientific" students are now included under arts, whereas they were formerly registered in the industrial college. The college of arts and sciences will hereafter grant the degree of bachelor of science, as well as that of bachelor of arts. There is a loss in the number of undergraduate women, probably due to transfers to the teachers college. The number of entrance points has been increased from 28 to 30, the new regulation to become operative on September 1, 1910.

New York University has a loss of 63 in the summer and of 33 in the fall enrollment. The chief losses in the present term are found in the schools of law, education and engineering, which gains in medicine and male undergraduates were not quite able to overcome.

Owing to the large first item of double registration, it is difficult to draw accurate conclusions concerning the changes in attendance on the different faculties of *Northwestern University*. The school of divinity and the male college department seem to be the only faculties to have suffered a loss, entries being made for the first time under the engineering school and

the graduate school. The total fall enrollment shows a gain of 137 students, the summer session a loss of 13 students. The students entered under "other courses" are registered in the department of oratory.

Ohio State University has had an encouraging increase both in this fall's and in last summer's enrollment, the gain being one of 202 and 139 students, respectively. The only faculties to suffer a loss are those of engineering, forestry and pharmacy, which in the case of the two departments last mentioned is only slight. Miss Edith D. Cockins, registrar, reports as follows:

The shortage in the engineering college is in the freshman class: an enrollment of 262 as against 301 the same date last year. The enrollment in the pharmacy college is 2 less than it was a year ago. In the college of arts there is an increase of 90; in agriculture an increase of 75; in law an increase of 75; in education an increase of 18; in veterinary medicine an increase of 15.

Mr. Edward Robins, assistant secretary of the *University of Pennsylvania*, has submitted the following report:

A comparison with previous figures shows that this is the largest registration in the history of the University of Pennsylvania, a distinct gain in the college, graduate school, law school, school of dentistry and school of veterinary medicine being noticeable. There is some falling off in the medical registration, but this was to have been expected. The requirements for admission to this school have been increased, and for the academic year 1909–10 candidates for admission into the school of medicine must have successfully completed work equivalent to that prescribed for the freshman class in colleges recognized by our university—this to include a knowledge of physics, chemistry and general biology or zoology, and together with appropriate laboratory work in each of these subjects, as specified by the College Entrance Examination Board, and two foreign languages, one of which must be French or German. Next year, 1910–11, candidates must have successfully completed work equivalent to that prescribed for the freshman and sophomore classes. The slight falling off in the medical registration therefore is a healthful sign, rather than one of weakness.

Princeton University shows an increase of 84 students, although the present enrollment is smaller than that of 1903. The graduate school has increased by 43 students, while changes in the distribution of academic and scientific students render comparisons in those departments impossible.

Mr. O. L. Elliott, registrar, reports as follows for *Stanford University:*

There are no general changes worthy of note in regard to the descriptive matter which you have specified. Our enrollment was depressed last year by the student upheaval of the previous year. This we have recovered the present year. The university is making no effort to increase the total attendance. In many ways we are still marking time and are uncertain as to the direction of the future development of the university.

The most important event during the last year was the establishment of a medical department. Only the first year of the course is given during 1909–10. The class beginning this year will be carried through, the second year being added in 1910–11, and so on. The first year's class numbers 13.

The 42 students in the law school are exclusive of 29 college seniors taking first year law.

Syracuse University reports as follows:

The apparent loss in the college of liberal arts is largely due to the fact that one course heretofore included in that college has been taken out and is counted elsewhere. We think the fact that our entrance requirement is 75 per cent., as against 65 per cent. upon thé part of many of the other colleges and upon the part of the requirement of the regents, has been militating somewhat against our attendance this year in the college of liberal arts. The loss in the college of medicine is due to the increased requirements—one year of college work. In 1910 two years of college work will be required for entrance.

The figures of the teachers college hardly give a fair impression of the work of that college. Three hundred and sixty-five students of the college of liberal arts are taking regular pedagogical work in the teachers college, but are not counted in the registration of that college. The college will hereafter be known as the Margaret Olivia Slocum Teachers College.

The courses in music and art show heavy gains, as does the registration under "other courses" (belles lettres, school of library, economy, etc.). The fall enrollment exhibits an increase of 54 students.

E. J. Mathews, secretary to the president, has submitted the following report for the *University of Texas:*

The total attendance is larger this session than ever before in the face of advanced entrance requirements in every department. The attendance on the law department is lower than heretofore on account of the going into effect this session of the requirement of five college courses. It is very probable that by another year the registration figures will be as large as ever. The attendance on the department of engineering is less than formerly, probably due to the fact that the only other school of engineering in the state has lowered its admission requirements.

The 47 students mentioned under "other courses" at *Tulane University* are taking work in domestic science.

Howard Winston, registrar, reports as follows for the *University of Virginia:*

The enrollment this fall slightly exceeds that of 1908. The increase has been in the college and engineering departments, notwithstanding the fact that two more units are required for entrance. Three years' residence are now required for graduation from the law school, instead of the two previously demanded, while a year of college work is now required for admission to the medical school, these changes causing a falling off in attendance on both faculties.

Western Reserve University shows a gain of 67 students over last year, an increase in undergraduate women, in the graduate school, the library school (other courses) and in dentistry more than offsetting slight losses in the undergraduate men, law, medicine and pharmacy. Leaving the graduate and library schools out of consideration, there is a gain of 35 new students over 1908.

The *University of Wisconsin* shows an increase in the fall total of 258 and in the summer session of 106. The students of commerce are for the first time listed separately, as are the students of home economics included under "other courses." There is a gain of 99 students of agriculture and of 85 undergraduate women. Medicine has experienced a gain of 18 and the graduate school one of 43 students. Mr. W. D. Hiestand, registrar, submitted the following comment:

Our total number of graduate students is 259. The 54 apportioned to professional schools includes graduate students taking work in engineering and agriculture. The number indicated as double registration are students taking work in two colleges; it is, therefore, impossible to eliminate this number and still do justice to the colleges concerned. The students represented in the school of music (108) are catalogued on a somewhat different basis from those of last year (216). In the reorganization of the school, the academic department has been discontinued and all candidates are now required to offer full college entrance requirements for admission, irrespective of their musical abilities. The figures will show a falling off in the college of engineering as compared with last year and also a slight decrease in the school of law.

Yale University exhibits a loss of 184 students in its fall enrollment, a considerable number of whom are law students. The academic department and medicine and music show smaller losses. The chief gains are in the graduate school and in forestry. To the scientific school registration should be added 170 graduate students included in the graduate school figures.

RUDOLF TOMBO, JR.
COLUMBIA UNIVERSITY

THE PHYSICAL LABORATORY OF THE NATIONAL ELECTRIC LAMP ASSOCIATION

A RESEARCH laboratory is now usually considered as a necessary adjunct to a large progressive, manufacturing organization. There are to-day many such research laboratories in operation in this country, employing men of scientific training and offering every facility for scientific investigation. The majority of these laboratories are engaged in chemical research, although in quite recent years the

importance and value of physical research have also been recognized, and some few physical laboratories have been established.

But although the establishment of a research laboratory by a large manufacturing organization is no longer novel, the inception, by such an organization, of a laboratory which has for its object the development of science rather than the improvement of some industrial commodity is probably without precedent. It, therefore, seemed to the writer that perhaps a brief description of the new physical laboratory of the National Electric Lamp Association, even though it is still only in the formative stage, might be of interest to the readers of SCIENCE. The object of this laboratory is scientific, the specific purpose being the development of those branches of science with which the art of lighting is closely associated. The fundamental idea which has prevailed in the organization of the work is the proper coordination of physics and physiology, the proper cooperation of the physicist, the physiologist and perhaps the psychologist.

The organization of the laboratory is proceeding with this idea as the foundation. The development contemplates no sharp distinctions among the different divisions of the work. The problems to be investigated, however, group themselves roughly into three classes, and therefore require, in order to insure the proper attention to each, a threefold division in the organization. The three groups of problems to be investigated may be classified as: (1) those that have to do with the production of luminous energy; (2) those that have to do with the utilization of luminous energy, and (3) those that have to do with the effects of luminous and attendant radiation.

Under the first class will come the investigation of the laws of radiation, and of the radiating properties of matter. The problems in this class are purely physical and the corresponding division will be entrusted to a competent physicist.

Under the third class will come the investigation of the effects of light and the attendant radiations on the eye, on the skin and on microscopic organisms. The problems in this class are physiological, and the corresponding division is under the charge of a trained experimental physiologist.

Intermediate between these two classes of problems (the first and the third) which are distinctly different, there is another (the second) which forms the connecting link. Touching on one side the physical production of light, and on the other the physiological effects of light, this intermediate division of the work will embrace most of the scientific problems peculiar to illuminating engineering. Investigations of the absorbing, reflecting and diffusing properties of matter, the measurement of light, *i. e.*, photometry, and the study of the complex phenomena of color and color sensation, properly come within the scope of this department of the work.

The present personnel of the laboratory, in addition to the director and the necessary auxiliary mechanical and clerical assistants, is as follows:

Mr. F. E. Cady, B.S., Massachusetts Institute of Technology, 1901; scientific assistant to the director. Mr. Cady was formerly assistant physicist in the Bureau of Standards, Washington.

Dr. Herbert E. Ives, B.S., University of Pennsylvania, 1905; Ph.D., Johns Hopkins University, 1908; physicist in charge of division II. of the work as outlined above. Dr. Ives was formerly assistant physicist in the Bureau of Standards, Washington.

Dr. Percy W. Cobb, B.S., Case School of Applied Science, 1894; M.D., Western Reserve University, 1902; physiologist in charge of division III. of the work. Dr. Cobb was formerly assistant in the physiological research laboratory and lecturer on the special senses at the Western Reserve University.

It is the intention to secure another physicist to assume charge of division I., and in addition several assistants, as soon as the development of the work justifies it.

The laboratory at present is established in a small one-story and basement brick building originally occupied as office and laboratory by Mr. Charles F. Brush. Adequate equipment

is being provided, and there are already available a complete instrument shop and a good working library, the two necessary adjuncts to scientific research.

EDWARD P. HYDE,
Director

CLEVELAND, OHIO

THE AMERICAN BREEDERS' ASSOCIATION

THE American Breeders' Association was organized in response to a long-felt need and to satisfy a desire among breeders of animals and plants for a central agency through which these interests might mork effectively in furthering their common welfare.

The objects of this organization are chiefly three: (1) to determine the laws of inheritance in animals and plants; (2) to learn the application of these laws to increasing the intrinsic, commercial and artistic values of living things; (3) to aid in bringing about this desired improvement through associated effort.

Much has already been achieved by breeders. The magnificent herds and studs scattered over North America are sufficient evidence that our animal breeders have not been idle and that they have builded wisely. The achievements of the breeders of field crops and horticultural plants have provided our modern journals and the daily press with material eagerly sought by a public which appreciates the wizard-like creations of these workers in plastic living forms. The productions of our florists and nurserymen brought forth in response to a popular demand for the artistic and novel, to the student of heredity, are monuments to the skill of the breeder and indicate the stupendous possibilities of similar work with our great economic animals and crops.

Great as have been the achievements of breeders, no definite science of breeding has been built up. Much investigation into the theory of heredity has been made and volumes of theoretical and experimental data have been accumulated through the efforts of the scientific workers. The plant breeders as a whole have their work in more scientific form than have the animal breeders. They are only on the threshold, however, of the science of breeding. Those who have attained success in breeding have often happened upon a valuable strain or method and exploited it with good results. Many who have met with success have only a very imperfect system. Some use artistic sense, or intuition, and judgment only. Others use statistical methods almost entirely. Whatever the practise of any successful animal or plant breeder may be, he can rarely advise his neighbor as to how to proceed and assure him of success. Each has been compelled to learn by costly experience and work in the hope that he may by chance hit upon a profitable method.

It was to bring order out of this chaos of theory and practise that the American Breeders' Association was created. The first step was to organize a large central association with a low membership fee which would place it within the reach of all of these thousands of modest unheard of workers in plants and animals whose collective experience must furnish much of the data upon which to build a practical science of breeding. By means of its annual and other meetings, this association is designed to become a great school and clearing house to which will be brought the latest and best thought in breeding from these many sources, and from which a balance will finally be struck upon which to base intelligent and practical work.

The need of a national association was first felt by those who were closely in touch with breeding work and had broadly observed the field. It has been found that the methods necessary to success in breeding make it expensive. Its pursuit is often beyond the means of the average producer, because large numbers of individuals must be available with which to work and great amounts of time and care are required in handling and recording each breeding unit. The breeding of many of the commercial field crops is beyond the means of private enterprise. The breeding of animals is many times more expensive than the breeding of plants. To be most effective, large plans and cooperative effort is necessary.

The field occupied by the American Breed-

ers' Association is, therefore, unique and of the highest economic importance. The United States produces annually about $5,000,000,000 worth of animals and crops which may be improved by careful breeding. A conservative figure, based upon the experience of those who have actually improved specific crops and breeds, justifies an estimate of 10 per cent. increase in this total by breeding alone. The cost of this improvement need not be more than 10 per cent. of the increase or one per cent. of the whole. Thus, $500,000,000 annually may be added to the wealth of the nation by breeding, representing a profit of $450,000,000.

Under a wise system of patent laws, invention and manufacture have been stimulated to produce and bring into wide use highly efficient forms of machinery which have greatly increased the efficiency of the agricultural producer. Through the further impulse given to better tillage and better farm management by state boards of agriculture, state experiment stations and the United States Department of Agriculture production has been greatly increased. The possible increase in the value of our plant and animal products through breeding alone is nearly as great as that now being realized through all these agencies. It is this task to which the American Breeders' Association is directing its efforts.

This work must be done by and through the practical animal and plant breeders with the aid of the scientific investigators and in cooperation with public agencies. Results can not be expected immediately, as much preliminary work must be done and years of effort will be required before permanent results can be expected in any line. Improved breeds and varieties can not be protected by patents and their further improvement thus stimulated and the breeder assured rewards for his skill and effort. In the nature of things improved strains soon become common property. The state and the national governments, therefore, should and will aid in placing this work on a substantial footing as soon as feasible plans are formulated and given adequate support.

The American Breeders' Association is at present attacking the first two of the problems before it, viz., the study of the little understood laws of heredity in living things, and the determination of such practical methods as can be applied in the actual improvement of plant and animal forms. This work is being centered in committees of from three to seven members, who are leaders along the lines for which they are chosen. Such problems as the business side of animal breeding, breeding meat-producing animals, the business side of plant breeding, breeding sugar crops, fiber crops, forage crops, cereal crops; breeding swine, breeding carriage horses, running horses, trotting horses, draft horses; breeding insects and bees, breeding fruits, breeding ornamental plants; breeding for the dairy, breeding general purpose cattle; the scientific investigation of the theory of heredity are taken up by the committees adapted to each subject. These committees report to the association at its annual and other meetings on the progress of their work and will make such recommendations to the society as they find wise and expedient. In this way the energies of the association will be centered upon the specific problems before it, while each committee has the resources of the entire membership to aid in its work.

The American Breeders' Association built up a membership of about one thousand, one hundred of whom are life members. This membership includes the foremost animal and plant breeders and scientists of this continent and many abroad. It has published five annual reports, a neatly-bound 400-page volume, containing the papers and addresses presented at the annual meeting and the records of the meeting.

W. M. Hays,
Secretary

Washington, D. C.

THE INTERNATIONAL CONGRESS ON THE EDUCATION OF CHILDREN AT HOME

The Third International Congress will be held under the patronage of the Belgian government, in connection with Universal Exposition at Brussels in August, 1910.

The idea of bringing together competent persons to discuss the subject of home (or family) education in its various bearings, and to formulate methods for promoting the physical, intellectual and moral well-being of children, originated in Belgium, and the First International Congress with this object in view met at Liège in 1905.

Interest in the movement, meanwhile, became wide-spread among educational authorities in the different states of Europe, while its importance as a possible means of diminishing criminal tendencies and so preventing crime and other anti-social evils was recognized by the various governments. This growing interest was manifested in the Second International Congress, convened at Milan in 1906 under the patronage of the Italian government.

The Third Congress, which is now announced, will extend and define the work already so auspiciously begun. The character and scope of the movement in its present stage of development will be, perhaps, best understood by referring to the program issued by the organizing committee of the congress, which has been prepared in the light of the experience gained in the former meetings.

The congress will consist of five sections:

Section 1—The study of childhood.

Section 2—The education of children: (*a*) general questions; (*b*) the education of children by their parents in the home; (*c*) cooperation of the family with the school; (*d*) education in the home after school.

Section 3—Abnormal children.

Section 4—Various subjects relating to childhood.

Section 5—Documentation.

An American committee has been appointed at the request of the Belgian government by Hon. E. E. Brown, United States Commissioner of Education, to stimulate interest in the work of the congress. This committee has organized a number of subcommittees, each representing one of the sections of the congress. An effort will be made to secure a large American representation in the sessions at Brussels.

Membership in the congress entitles to a copy of the Proceedings. The membership fee is two dollars, and may be sent either to the general secretary, 44 due Rubens, Brussels, or to the secretary of the American committee.

Administrations, educational bodies and philanthropic societies can take part in the congress and be represented by a delegate. A subscription must be paid for each delegate.

Those who subscribe not less than ten dollars become honorary members. Subscriptions of this type are needed to defray the general expenses of the propaganda.

Papers and discussions may be presented in any of the following languages: French, German, English, Dutch, Italian and Spanish.

Americans wishing to participate in the discussions of the congress, or to further its work by becoming members, should communicate with the secretary of the American committee, Professor W. C. Bagley, Urbana, Ill.

THE MINING EXPERIMENT STATION AT THE UNIVERSITY OF NORTH DAKOTA

IN order to promote the development of the mining and allied manufacturing interests of the state and especially to aid the utilization of the great deposits of lignite coal and the valuable clays, a Mining Experiment Station has been created as a part of the School of Mines at the University of North Dakota and a branch Mining Experiment Sub-station established at Hebron, North Dakota.

The work of these two stations will be carried on jointly. Certain lines of investigation which require much laboratory equipment and research will be taken up at the School of Mines. When conclusions have been reached here through experimental work in the laboratory, these conclusions will at once be put to a practical working trial at the testing-out plant of the sub-station. In other words, a large part of the work of the sub-station will be for the purpose of proving in a practical way and on a commercial basis, the conclusions reached in the laboratories.

In order to provide adequate facilities for carrying on these investigations at the university, as well as to provide room for the

rapidly increasing number of students taking mining engineering work, it has been necessary to add two wings to the School of Mines building and to employ additional assistance. Certain laboratories will be set aside for the experimental and research work on gas, coal, clays, building materials, cements, etc., and for this work the laboratories will be among the very best equipped in America. This work is unquestionably of very great importance to the state.

The research which has already been carried on in the Mining Engineering College of the State University relative to lignite, coal, gas and clays has attracted the attention of many men throughout the country who are interested in these subjects. It is intended to build up laboratories and carry on investigations which will be a help to the state.

The work which will be taken up most vigorously during the coming year will be for the purpose of obtaining by investigations and practical tests, a cheap and commercially satisfactory method of lignite coal briquetting, to show the best methods of burning lignite, and to determine the possibility of utilizing lignite for producing gas for light, heat and power. Considerable attention will be given also to the utilization of the high grade clays of the state for the manufacture of a variety of wares.

In order to carry on this work on a practical commercial basis, considerable machinery of special design will be installed at the sub-station at Hebron. For several months work has been devoted to machinery and methods which seemed to be suited to the manufacture of briquettes from lignite. As a result complete briquetting plant has been designed and is now being built. The press will have a capacity of 2 tons of briquettes per hour. In addition to this a specially constructed gas plant is being made for the purpose of manufacturing gas for light, heat and power from lignite coal. This will be one of the most perfect types of gas plants and large enough to produce several thousand cubic feet per day. Machinery and kilns of commercial working size will be installed later for practical testing of the higher grade clays.

THE ELIZABETH THOMPSON SCIENCE FUND

In January, 1910, there will be a meeting of the trustees of the Elizabeth Thompson Science Fund for the award of grants. Applications, in order to be considered at that time, should reach the secretary, Dr. C. S. Minot, Harvard Medical School, Boston, before January 15, 1910. All applications *must be accompanied by full information,* especially in regard to the following points:

1. Precise amount required.
2. Exact nature of the investigation proposed.
3. Conditions under which the research is to be prosecuted.
4. Manner in which the appropriation asked for is to be expended.

The trustees are disinclined, for the present, to make any grant to meet ordinary expenses of living or to purchase instruments such as are found commonly in laboratories. Decided preference will be given to applications for small amounts, and grants exceeding $300 will be made only under very exceptional circumstances. Preference will be given to those investigations which can not otherwise be provided for.

THE BOSTON MEETING OF THE AMERICAN ASSOCIATION

The hotel headquarters for physicists at the Boston meeting of the American Association for the Advancement of Science and the American Physical Society will be the Hotel Brunswick, Boylston Street, near Copley Square, which is also the general association headquarters. Rates: single rooms, $1.50 to $2.50; double, $2.50 to $3.50; with bath, single, $2.50 to $3.50; double, $3 to $4.

Section B has a joint session with Section A on Tuesday afternoon, December 28, immediately after the address of Vice-president Guthe. Interesting papers will be presented by Professors G. Runge, A. A. Michelson, E. W. Brown and H. F. Reid.

Friday morning, December 31, there will be

a joint session of Section B and Section L, the former furnishing the program. Speakers will be Professors E. H. Hall, A. G. Webster, J. F. Woodhull, C. R. Mann and probably Presidents E. F. Nichols and N. H. Black.

The Engineering Section (D) of the American Association for the Advancement of Science will hold its meetings in Room 31, Engineering Building A, Trinity Place, Boston, on December 29 and 30. Professor G. F. Swain, retiring chairman of the section and vice-president of the association, will deliver his address at 2:30 P.M. on Wednesday, December 29, subject, "The Profession of Engineering and its relation to the American Association for the Advancement of Science." Other papers have been definitely promised as follows:

Professor A. L. Rotch: "The Relation of Wind to Aeronautics."

O. Chanute: "The Present Status of Aerial Navigation."

S. P. Ferguson: "Wind Pressure and Velocity."

A. J. Henry: "Shifting of Wind with Altitude."

A. M. Herring: "Aerodynamics."

Albert Zahm, Alexander Graham Bell and others will probably contribute papers or discussions on aeronautical subjects.

C. J. H. Woodbury: "The Development of the Modern Textile Mill."

J. F. Kelly: "Music Roll Cutters."

H. E. Wetherill: "Parallel Rules."

E. H. Berry: "The Photographic Lens as an Engineering Implement."

Other interesting papers, for which titles can not yet be announced, will be on the program. The dates and hour of presentation of each paper will be announced in the Official Program of the Association which will be obtainable at the office of the Permanent Secretary, Technology Union, Trinity Place, on Monday, December 27.

SCIENTIFIC NOTES AND NEWS

MR. WILLIAM H. HOLMES, chief of the Bureau of American Ethnology, will on January 1 sever his official connection with the bureau and resume his place as head curator of anthropology in the U. S. National Museum, and in this connection will also become curator of the National Gallery of Art. Mr. F. W. Hodge will take charge of the Bureau of American Ethnology with the title ethnologist in charge.

IT is proposed to add to the collection of portraits of deceased members of the American Philosophical Society that of Professor Simon Newcomb. The formal presentation of the portrait is expected to take place in connection with the annual meeting in April, 1910. The committee in charge is: C. L. Doolittle, chairman, E. C. Pickering, Ernest W. Brown, Ira Remsen and Charles D. Walcott.

DR. THEODORE W. RICHARDS, professor of chemistry at Harvard University, has been elected a corresponding member of the Paris Academy of Sciences.

DR. ALBRECHT PENCK, professor of geography at Berlin, has been elected a corresponding member of the Munich Academy of Sciences.

DR. W. WALDEYER, professor of anatomy at Berlin, has been elected an honorary member of the Anthropological Society of that city.

PROFESSOR A. C. SEWARD, F.R.S., professor of botany in the University of Cambridge, has been elected president of the Yorkshire Naturalists' Union.

THE Walsingham medal for 1909 has been awarded by Cambridge University to Mr. L. J. Wills, for his essay entitled "The Fossiliferous Lower Keuper Rocks of Worcestershire," and a second medal to Mr. H. H. Thomas, for his essay entitled "The Leaves of Calamites (Calamocladus section), with special reference to the conditions under which they grew."

THE La Caze prize (10,000 francs) of the Paris Academy of Sciences has been given to Dr. Delezenne, of the Pasteur Institute, for his collective works.

MR. THEODORE D. URBAHNS, of the Bureau of Entomology, has been employed as assistant in research field work by the division of en-

tomology of the University of Minnesota Experiment Station.

Mr. E. J. McCaustland, professor of municipal engineering, University of Washington, has been appointed sanitary engineer to the State Board of Health.

Dr. Ejnar Hertzsprung, associate professor at Göttingen, has been elected observer in the Astrophysical Observatory at Potsdam.

It is proposed that a grant of £100 be made from the Worts Fund, Cambridge University, to Mr. J. Romanes, towards defraying the expense of a journey to Costa Rica with the object of studying the geology and geography of that country.

Dr. Charles Peabody, of Harvard University, recently made an archeological reconnaissance trip in Texas. The archeology of the mountainous region of the state, for some three hundred miles, was studied, and a fair collection of the stone implements secured for the Peabody Museum. The pictographs of the area were also investigated. During the summer, Dr. Peabody represented the museum at the Congrès Préhistorique at Beauvais, France, presenting a paper covering the results of his investigations in Texas.

Mr. W. Dawson Johnston, librarian of Columbia University, is preparing for the United States Bureau of Education a report on special collections in libraries in the United States. It is planned to make the publication a record of all collections in public libraries which are of extraordinary value, either because of their completeness or because of the rarity of their contents. In order to collect the material for this report the Bureau of Education is sending circulars to all libraries which are thought to possess such collections.

A course of lectures upon Abnormal Psychology will be given by Dr. Morton Prince, of Boston, at the University of California, from January to April, 1910.

The Friday evening meetings of the Royal Institution, London, will commence on January 21, when Sir James Dewar will give a lecture on light reactions at low temperatures. Succeeding lectures will probably be given by the Rev. Canon Beeching, Professor W. Bateson, Mr. C. E. S. Phillips, Professor H. H. Turner, Lord Rayleigh, Dr. C. Chree, Dr. H. Brereton Baker and Sir J. J. Thomson.

On December 15 the name of Cyrus Hall McCormick was installed in the Illinois Farmers' Hall of Fame at the University of Illinois. A portrait of Mr. McCormick was unveiled by his granddaughter, Miss Muriel McCormick. Among the speakers were Governor Charles Deneen, President E. J. James and Mr. Cyrus Hall McCormick, the son of the inventor. The next name to be enrolled in this Hall of Fame is that of Jonathan B. Turner, the originator and promoter of the idea of a National Land Grant for agricultural colleges in the states.

Professor Hilary Bauerman, formerly of the Royal Artillery College, Woolwich, well known as a metallurgist and geologist, died on December 5, at the age of seventy-six years.

It is announced that the council of the University of Paris has passed a resolution to the effect that monuments intended to commemorate men who have brought distinction on the University of Paris since 1808 shall be erected in the church of the Sorbonne.

The New York State Science Teachers Association will hold its fourteenth annual meeting at Syracuse, N. Y., on December 27, 28 and 29, in conjunction with the Associated Academic Principals and other educational bodies. The president of the association is Professor W. M. Smallwood, of Syracuse University.

The week of December 6–11 was appointed by the International Commission for Scientific Aeronautics for the long series of observations in the upper air. The United States Weather Bureau was unable to make the ascensions of sounding balloons promised at Omaha, but three of these balloons were sent up by Professor A. L. Rotch, from Pittsfield, Mass., and two pilot balloons, for wind direction and velocity, from Blue Hill Observatory.

One of the sounding balloons, with good records of pressure and temperature, has already been recovered.

WE learn from the London *Times* that the British Natural History Museum will shortly be enriched by Lord Walsingham's gift of his unrivaled collection of Micro-Lepidoptera. which will be transferred from Merton Hall to Cromwell-road in the spring of the coming year. The collection which thus passes into the possession of the nation is by far the richest of the kind in the world. When examined by the museum specialist in 1901 it was officially reported to the trustees to contain over 200,000 specimens, in a condition of preservation which left nothing to be desired, and to include about nine tenths of the recorded species, besides a large quantity of unworked material. Since that date it has continually been added to, until now the number of specimens is about 260,000. It will add about 45,000 species of Micro-Lepidoptera to the national collection, which at present possesses only about 4,000 species of these small insects. In addition, Lord Walsingham is presenting to the nation an important library of the literature dealing with the subject. His previous gifts have comprised at least 15,000 specimens. Among these may be specially mentioned a collection of insects from California and a series of more than 1,000 moths of the family Pyralidæ. Another donation which forms a specially attractive feature of the museum is the collection of British butterflies and moths, in which the caterpillars, at various stages of their growth, are exhibited on their food-plants with the perfect insects. The preparation of the caterpillars for exhibition, an operation requiring a considerable amount of technical skill, was in great part the work of Lord Walsingham himself. The illustrations of the nesting habits of British birds include no fewer than 49 groups obtained and given by Lord Walsingham.

AT the University of Montana one of the features of the newly organized work in forestry is a short course for rangers employed in the United States Forest Service. By arrangement with the officers of District No. 1, with headquarters at Missoula, a number of men from each of the national forests in the district will be detailed for attendance on the courses, which will occupy the time of the rangers for the months of January, February and March, while the field work is suspended. About sixty men are expected to register for the courses this winter.

THE U. S. Geological Survey's summary of the mineral production of the United States in 1908, prepared by W. T. Thom, issued as an advance chapter of "Mineral Resources of the United States, Calendar Year 1908," shows a decline in the value of the country's mineral output amounting to about $476,000,000, or 23 per cent. The figures for 1907 and 1908 are $2,071,607,964 and $1,595,670,186, respectively. The loss is due to a decrease in the output of both metallic and non-metallic products. The most notable decreases among the metallic products were in the production of iron ores (30 per cent. in quantity and 38 per cent. in value) and of pig iron (38 per cent. in quantity and 52 per cent. in value). The production of bituminous coal decreased about 16 per cent. Gains are shown in the production of gold and in the quantity of copper produced, but this gain in quantity was accompanied by a loss in total value, due to the lower prices of copper. Petroleum showed a gain of about 8 per cent. in quantity and value, 179,000,000 barrels having been produced in 1908 and 166,000,000 barrels in 1907. Considerable gains in mineral production were made by several states. California gained 15 per cent., Florida 24 per cent., Louisiana 11 per cent., New Hampshire 16 per cent. and South Dakota 72 per cent. The losses, however, were out of proportion to the gains. Alabama lost nearly 33 per cent., Colorado 17 per cent., Illinois 15 per cent., Michigan 34 per cent., Montana 22 per cent., New Jersey 35 per cent., New York 33 per cent., Ohio 35 per cent., Pennsylvania 28 per cent., Virginia 32 per cent. and West Virginia 16 per cent.

THE annual report of the Liverpool Marine Biology Committee and the Port Erin Biological Station was submitted by Professor Herdman at a meeting of the Liverpool Bio-

logical Society on November 12. In the course of his address, according to the report in *Nature,* Professor Herdman gave an account of the work, both scientific and economic, carried out during the past year, such as the curator's report upon the hatching and setting free of more than seven millions of young plaice, making a total of 25½ millions during the six years the hatching has been in operation; the experiments in lobster rearing; Dr. Ward's investigations on the eggs and young larvæ of the plaice (illustrated by many very beautiful enlarged photographs); Mr. Gravely's work on the development of the brittle-star-fish; Dr. Herbert Roaf's researches on digestion in marine animals; Mr. Dakin's physico-chemical observations on the condition of the sea-water at different times in connection with the migrations of the food of fishes; Mr. Edwin Thompson's photomicrographs of various types of minute organisms in the sea; and Professor Herdman's own investigations into the detailed distribution of life in the sea. Some of the biological stations and establishments for fish culture in Canada and the United States were also described, and attention was directed to the American system of providing dormitories and dining halls for the students and researchers, and to the manner in which men of wealth in the states advance science by making large donations to such laboratories in order to defray the expenses of special investigations or marine and other explorations.

The *Journal* of the American Medical Association summarizes recent vital statistics for England and France. It appears that the registrar-general's return for the quarter ending September again records a decreased birth-rate for England and Wales, the proportion being 25.4 annually, which is 2.5 below the average for the ten corresponding quarters and is the lowest for any third quarter of the year since the establishment of civil registration. On the other hand, the deaths were only 11.6 per 1,000, which was 3.4 below the average for the last ten years, and again the lowest on record for the period in question. Taking the two returns together, the natural increase in population by excess of births over deaths was 123,878, as against 123,197 in 1908. The low death-rate is all the more remarkable, as the weather conditions have been unfavorable. The summer months included only one substantial spell of fine seasonable weather. Thanks to the great attention which is now being paid to infant hygiene, the mortality of infants under 1 year showed the large decrease of 38.6 per cent. Statistics in regard to the fluctuation of population in France during the first semester of the present year have just been published. Here are the comparative figures of births and deaths for the first semester of the years 1908–9:

	1909	1908
Births	398,710	411,402
Deaths	426,913	401,894

Thus the number of births has diminished by 12,692, and at the same time the number of deaths has increased by 25,019. The population of France has diminished by 28,203, figures representing the excess of deaths over births. Almost all the departments of France have contributed to this diminution of the population, but the excess of deaths over births is often particularly marked in the departments which contain large cities, as the departments of the Seine (Paris), Rhône (Lyons), Gironde (Bordeaux), Bouches-du-Rhône (Marseilles), Haute-Garonne (Toulouse), etc. Only in some departments of the north and west is an excess of births over deaths recorded.

The production of gold in the United States in 1908 was 4,574,340 fine ounces, valued at $94,560,000, an increase of 199,513 fine ounces over the production in 1907, which was 4,374,827 fine ounces, valued at $90,435,700. The production of silver in 1908 was 52,440,800 fine ounces, valued at $28,050,600, a decrease in quantity and in value from 1907, when the production was 56,514,700 fine ounces, valued at $37,299,700. On the whole the gold-mining industry had in 1908 a prosperous year in spite of many adverse conditions of trade and finance. The production during the year is the largest annual output

yet recorded. The silver mining industry presents a condition far less satisfactory, owing to the low prices of silver, lead, copper and zinc. Important mines in Colorado and Utah found it difficult to make profits on low-grade ores, and large smelters in these states were closed during part of the year or were operated with reduced capacities. A temporary lack of demand for silver in India, and a very heavy production in Canada contributed to the depression in price. The average price per ounce during the year was 53 cents, as against 66 cents in 1907. The Geological Survey's report on gold and silver in 1908, prepared by Messrs. Waldemar Lindgren and H. D. McCaskey, may be had by applying to the director of the survey at Washington.

ACCORDING to a notice in the London *Times* the project described recently by Sir William Willcocks at a meeting of the Royal Geographical Society promises to be the most important engineering undertaking of the near future. An irrigation scheme is being planned for the rehabilitation of Mesopotamia upon such a scale that 3,000,000 acres of the best land in that country will be provided with water. If it is carried out, the Tigris, the Euphrates and the Akkar Kuf Lake will form part of a controlled system of canals, weirs and barrages, whereby the pernicious silt is to be separated, floods are to be prevented and wheat-bearing land is to be nourished with water. It is estimated that the cultivated area will be doubled, and that the crop of wheat along the Euphrates will be trebbled. The scheme would also result in a vast increase in the yield of cotton. Briefly, it consists of providing a means of escape for the flood waters of the Euphrates along the depressions of the Pison, but it also entails the construction of a great central canal, regulators to control the supply from the Euphrates at the head of the Sakhlawia, a weir on the Tigris, a canal for irrigation to the north of Baghdad, another canal along the right bank of the Tigris and the building of a railway along the left bank of this canal for the transport of the harvests. Moreover, the construction work would include a railway to connect Baghdad with the Mediterranean by a short and cheap route.

UNIVERSITY AND EDUCATIONAL NEWS

THE trustees of the University of Pennsylvania announce that Mr. Henry Phipps, of New York, founder of the Phipps Institute in Philadelphia, has presented to the university $500,000, to be used in the campaign against tuberculosis. The management of the Phipps Institute will be in the hands of the university, and the study, treatment and prevention of the disease will be continued in a new hospital to be erected at Seventh and Lombard Streets. Six years ago Henry Phipps founded the Phipps Institute for Tuberculosis Research in Philadelphia, with a large endowment. In 1908 he gave $500,000 to the Johns Hopkins University for the founding of a psychiatric clinic.

THE eleventh industrial fellowship at the University of Kansas has been established by the Pacific Coast Borax Company of Oakland, California, and will be known as the Borax fellowship. The amount which this company will pay to support the work of its fellow is $750. The purpose of the fellowship is to investigate the uses of borax and to discover if possible new commercial utility in this product.

THE cornerstone of the new science hall of Howard University was recently laid by Richard A. Ballinger, secretary of the interior. Addresses were delivered by Dr. Robert S. Woodward, president of the Carnegie Institution of Washington and Dr. Charles Wardell Stiles, director of the Rockefeller fund for combating the hook-worm disease. An appropriation of $90,000 was made by the last congress for the erection of this hall.

LECTURES in veterinary science are to be given in the College of Agriculture of the University of Wisconsin this year during the second semester as a result of the appointment of Dr. John Spencer, of Pulaski, Va., as special lecturer in veterinary science. In addition to his lectures Dr. Spencer will have

veterinary supervision of the university flocks and herds.

THE department of mining engineering of the University of Illinois has just issued its first circular of information. The course of study required for the degree of B.S. in mining engineering covers the usual period of four years. The technical studies relating to mining are begun in the sophomore year, mining principles in the first semester and earth and rock excavation in the second semester. In the junior year the study of mining methods, mine surveying and mine ventilation is pursued. In the senior year more time is devoted to the subjects relating particularly to mining. They are mechanical engineering of collieries, mine administration and organization, mining law, mining laboratory and economics of coal. Professor H. H. Stock, head of the department has been appointed a member of the Mine Commission by Governor Deneen. A Mine Explosion and Rescue Station has been established at the university under the direction of Mr. R. Y. Williams.

IT has been decided by Balliol College to offer next year an exhibition of £80 a year, tenable for two years, for the competition among students recommended by trade unions operating in Newcastle.

FOR the recently constituted degree of bachelor of science in agriculture at the University of Manchester, special courses have been prepared. The practical work will be carried on at the college of agriculture and horticulture at Holmes Chapel under the supervision of the principal, Mr. T. J. Young, who has been appointed a lecturer in the department of agriculture in the university.

THE professorship of natural history at the College of the City of New York has been filled by the promotion of Dr. Ivin Sickels, assistant professor, who since the death of Professor Stratford has directed the affairs of the department. Professor C.-E. A. Winslow, of the Massachusetts Institute of Technology, has accepted an appointment as associate professor of biology in the College of the City of New York and has been made curator of public health in the American Museum of Natural History. Professor Winslow is lecturing at the University of Chicago, on leave of absence from the institute during January, February and March, returns to Technology for the rest of the spring term and goes to New York in September.

DR. JOSEPH EVANS, of Philadelphia, has been appointed professor of clinical medicine and medical adviser to the students of the University of Wisconsin.

MR. HAROLD K. BARROWS, of the U. S. Geological Survey, has been appointed to the position of associate professor of hydraulic engineering at the Massachusetts Institute of Technology, made vacant by the resignation of Professor William E. Mott.

DISCUSSION AND CORRESPONDENCE

THE TEACHING OF ELEMENTARY DYNAMICS IN THE HIGH SCHOOL

TO THE EDITOR OF SCIENCE: So the teachers of physics have at last recognized and confessed the fact that they do not know how to teach elementary dynamics (or kinetics) to high school students, and they think they have discovered the cause of their trouble, viz., the multiplicity of forms in which the "youngster" is taught the familiar formula

$$\text{force} = \text{mass} \times \text{acceleration},$$

one of these forms being

$$\text{force (poundals)} = \text{mass (pounds)} \times \text{accel. (ft. per sec. per sec.)}^{1}$$

Instead of drawing the obvious conclusion, "let us simplify the subject and get rid of some of the forms, especially the one with the 'poundal' in it," the physicists are actually talking of running away from the difficulty. A majority of a conference of physicists have signed a statement which proposes among other things "that colleges should require of the schools no quantitative treatment of kinetics, or the behavior of matter undergoing acceleration."

To this lame and impotent conclusion have the teachers of physics come after years of blindly following the modern text-books. The aim of these text-books seems to be not to make

[1] See Professor Edwin Hall's paper in SCIENCE, October 29.

the subject of dynamics clear and interesting to the student, but to muddle it as much as possible with "poundals," "gee pounds," dynes, etc., and with such statements as "force is the time-rate of acceleration," etc. When the student gets into college he has to forget much that he has been trying to learn before he can get the clear concepts of dynamics that are necessary to further progress in the subject.

I have taught elementary dynamics to some high school students who were floundering with the mysteries of the text-book, and have also taught it to college students who combined a parrot-like memory of the words of the book they had used with total inability to make intelligent use of first principles. It may be of interest to some readers to have a short syllabus of my method of beginning the subject. Here it is:

Matter.—A stone is suspended by an elastic cord from a nail driven into a projecting shelf. The stone is a piece of matter. Define matter. Quantity of matter, determined by measuring (bulk or volume), or by weighing (weight). Bulk is inconstant and inexact, varying with temperature, porosity, etc. Weight (determined by weighing on an even balance scale) is exact and constant. The weight of the stone is *W pounds.* The unit of weight is the pound. The standard pound is kept in London and copies are made of it.

Force.—The cord is stretched when the stone is hung on it. Measure the stretch per foot of length. Why is the cord stretched by the stone? Attraction of the earth's gravitation. But the cord may be stretched by pulling it between the two hands horizontally. Also the cord with the stone or weight hung from it will return to its unstretched length if the stone be pushed upwards by the hand through a distance equal to the stretch. The pull of the earth upon the stone (gravitation), the opposite pull of the elastic cord on the stone, the pull of the hands, the push upwards by the hand, each is called by the name *force.* Force is defined as a pull or a push, something that causes or tends to cause either motion, or a change in the velocity or direction of motion. As the weight of a body (quantity of matter) is stated in pounds, so the amount of a force is also stated in pounds, a pound of force being defined as equal to the force with which the earth's gravitation attracts a one-pound weight. Force is generally represented by F. The force of the earth's gravitation acting on the stone whose weight is W pounds, is also W pounds, or $F = W$.[2] Force may be measured or weighed by a spring balance graduated in pounds, or by counterpoising it with weighted levers (illustration, the lever safety valve), or in other ways. This force varies somewhat with the latitude of the place, being about $\frac{1}{1000}$ part greater at London than at Philadelphia, but in ordinary and elementary problems relating to force, this difference is neglected. In advanced studies it will be considered.

We have thus far considered two different things, matter and force and the method of determining the quantity of each; W and F.

Space, Time.—Now let the cord be suddenly detached from the stone. The stone falls to the ground. It traverses a certain distance, which we call space, S, measured in feet, during a certain time, T, in seconds. We now have all four of the elements, or concepts, of dynamics, matter, force, space, time, represented by W, F, S, T. The whole science of dynamics is built on these four elements, and it may be defined as the relations existing between them when force acts on matter through space and in time.

Velocity, etc., of Falling Bodies.—The simplest case of the relation of these elements is that of a falling body, when the force acting in pounds is numerically equal to the pounds weight, or quantity of matter W. By experiment it has been found that when a body falls freely in air

for seconds $T =$	1	2	3	4	5
it will fall in each of the several seconds 16.1 ft. $\times$	1	3	5	7	9
And the total fall at the end of each second is $S = 16.1$ ft. $\times$	1	4	9	16	25

[2] The term "weight" is correctly used both as a measure of a quantity of matter and as a measure of the force with which that quantity would be attracted by the earth at London.

The velocity at the end of each second is $V = 32.2$ ft. per second $\times$	1	2	3	4	5
The increase of velocity per second is 32.2 ft. per second $\times$	1	1	1	1	1

Velocity, V, is here defined as the rate of motion. It is the space traversed divided by the time, $S \div T$, if the velocity is uniform. If it is not uniform, but increases at a constant rate, as in falling bodies, then the average velocity during any time, T, is $S \div T$. If the velocity is 0 at the beginning of any time T and V at the end of the time, then $V = 2S \div T$. The relation of time, space and velocity when the velocity is uniformly increasing may be illustrated by a right-angled triangle in which the bases are T and V and the area S.

$$S = \tfrac{1}{2}VT, \quad V = 2S \div T \qquad (1)$$

Expressing algebraically the results given in the above table we find

Total fall, $S = 16.1 \times T^2$, or if

$$g = 32.2, \; S = \tfrac{1}{2}gT^2 \qquad (2)$$

Velocity at the end of the time T,

$$V = 32.2 \times T = gT \qquad (3)$$

Velocity at the end of the fall S,

$$V = \sqrt{2 \times 32.2 \times S} = \sqrt{2gS} \qquad (4)$$

The last equation is commonly written $V = \sqrt{2gH}$, in which H = height of fall.

Acceleration.—A, $= V \div T =$ rate of increase of velocity, $= 32.2$ ft. per second in each second in the case of falling bodies at London. This quantity, 32.2 ft. per second per second, is commonly represented by g, and it is called the acceleration due to the earth's gravitation, or more briefly, the acceleration due to gravity.

Force causing Acceleration.—In the case of a falling body, a force which equals the weight W acts on the weight and causes it to move with an acceleration $A = 32.2$ ft. per sec. per sec. Suppose the weight is not a falling body, but a weight supported on frictionless rollers on a level plane, or a body floating in still water, and a constant force is applied to it horizontally, say by a cord the tension in which is kept constant and measured by a spring balance. What then will be the acceleration? The force is the cause of acceleration, and the acceleration is the effect of force. In general an effect is proportional to its cause. If the force applied to the weight is one tenth of the force of gravity, then the acceleration is one tenth that which would be caused by gravity, or 0.1 g or 3.22 ft. per sec. per sec.

Let W = weight, g = the acceleration that would be given by a force equal to W, A = the acceleration that would be given by any other force F, then

$$A : g :: F : W,$$

or the acceleration produced by any force F is to the acceleration due to gravity as the force F is to the weight of the body, or

$$A = gF/W. \qquad (5)$$

From this equation we see that the acceleration is proportional to the force, and inversely proportional to the weight. Illustrate this by Atwood's machine and by experiments on weights supported on rollers or floating in water. Writing A instead of g in the equations (2), (3) and (4), they become general and apply to all cases of uniformly accelerated motion, as well as to falling bodies.

Total space traversed in time T, $S = \tfrac{1}{2}AT^2$ (6)

Velocity at the end of the time T, $V = AT$ (7)

Velocity at the end of the space S,

$$V = \sqrt{2AS} \qquad (8)$$

Example (1), A boat in a canal weighs 20,000 pounds. If a boy pulls it with a string with a constant pull of 10 pounds, what velocity will the boat have acquired at the end of a minute, friction being neglected? Ans. 0.966 foot per second. (2) If an air gun has a bore 5 feet long and 1 square inch area, a bullet weighing one pound sliding frictionless in the bore, and propelled by compressed air supplied from a large reservoir at a constant pressure of 2,000 pounds per square inch behind the bullet, what will be the velocity of the bullet as it leaves the gun? Ans. 802.5 feet per second.

In the equation (5) $A = gF/W$, F and W are known and A is to be found, but if the acceleration is known, and also either one of the other two quantities, F or W, the third quantity may be found. Thus,

$$WA = gF, \text{ whence } W = gF/A \qquad (9)$$

and

$$F = W/g \times A. \qquad (10)$$

That is if a force produces a uniform accel-

eration A in a body whose weight is W, then the force in pounds is numerically equal to the weight in pounds divided by 32.2 and multiplied by the acceleration in feet per second per second.

Work, Energy, Effect of Force Acting through Space.—If a weight W is lifted against gravity through the height H, the product WH is called work, in foot-pounds. It is equal to the force exerted through distance, or $FS = WH = WS$. If the body falls through the space S, it acquires a velocity $\sqrt{2gS}$. If it is moved a distance S by a constant force F, other than the force of gravity, with an acceleration A, then the acquired velocity $V = \sqrt{2AS}$, from which $S = V^2/2A$. Taking this equation together with equation (10) $F = W/g \times A$, we find

$$FS = \tfrac{1}{2}W/g \times V^2. \qquad (11)$$

Work is defined as the sustained exertion of force through space, and its quantity, measured in foot-pounds, is the product of the force by the space, $F \times S$. If the force is exerted to lift a weight W through the height H, and the weight is stored at the top of the lift, it is evident that it is capable of being used to do work (illustrate). This capacity of a body at rest for doing work is called *potential energy.* If the body falls through the height H, it acquires a velocity $\sqrt{2gH}$, and it is capable of doing work by reason of that velocity, on any body which may offer resistance to its motion. This capacity is known as *kinetic energy,* or energy of motion, and its quantity is expressed by the second term of equation (11), viz., $\frac{1}{2}(W/g)V^2$ and is stated in foot-pounds. Let us collect together some of these equations for review:

(5) Acceleration in terms of weight and force,
$$A = Fg \div W,$$
(10) Force in terms of weight and acceleration,
$$F = W/g \times A,$$
(11) Energy in terms of weight and velocity,
$$FS = \tfrac{1}{2}W/g \times V^2.$$

If we replace the expression $W \div g$ by the letter M, the equations take a simpler form:

(5a) $$A = F \div M,$$

(10a) $$F = MA,$$

(11a) $$FS = \tfrac{1}{2}MV^2.$$

Mass.—It is convenient to call the quantity $M = W/g$ by a name, and the name "mass" has been given to it, although this name is perhaps unfortunate, since the word mass is also used in other senses. Thus it is commonly used to mean an indefinite quantity of matter, as a lump or portion. It is also used by many text-book writers in the sense in which we have used the word weight, for a definite quantity of matter stated in pounds, and these writers try to restrict the word weight to mean only the force with which the earth attracts matter. (Do not tell the student that "the engineer's unit of mass is 32.2 pounds." The engineer has no such unit. When he weighs a quantity of matter he records the result as a weight, and his unit is a pound.)

Giving the word mass to the quantity W/g, the above equations may be read thus:

(5a) Acceleration equals force divided by mass,
(10a) Force equals mass × acceleration,
(11a) Force into space = ½ the product of the mass by the square of the velocity.

Momentum.—From equation (7) $A = V/T$; substituting this value of A in equation (10a) $F = MA$, we obtain $F = MV/T$, whence

$$FT = MV. \qquad (12)$$

This may be explained to mean that a force F acting constantly on a mass M $(= W/g)$ which is free to move, will in the time, T, give it a velocity V. The quantity FT is sometimes called *impulse,* and the quantity MV *momentum,* and the equation is said to show the equality of impulse and momentum. (In some books momentum is called quantity of motion, but this is an error; it is merely the product of mass and velocity.)

The following equations should be memorized, as they are constantly needed in solving problems in mechanics:

$V = \sqrt{2gH}$, velocity of falling bodies,
$F = MA = MV/T$, force equals mass × acceleration,
$FS = \frac{1}{2}MV^2$, force into space equals energy,
$FT = MV$, force into time equals momentum.

By these four equations and their algebraic

transformations, nearly all problems in dynamics (except those relating to impact) may be solved. The sign = is to be considered as meaning only "is numerically equivalent to," and never as meaning "is," as in the inaccurate statement "force is the time rate of momentum."

The main ideas in the above syllabus are:

1. That words should be used as far as possible in their most common meaning; thus, "weight," and not "mass," is the word that means, in ordinary language, the quantity of matter expressed in pounds.

2. That the English system of weights and measures is used until the subject has been carried as far as this syllabus extends. The metric system can now be used with the same equations, and the C.G.S. system with its "dimensions" postponed to the end of the course.

3. An attempt has been made to use no more technical terms and definitions than are absolutely necessary. The poundal and the gee-pound are ignored and the dyne and the erg postponed.

4. Force is treated as an entity, capable of being measured directly as matter and space are, and not as a mere mathematical function derived from length, mass and time.

5. The word "mass," which gives most difficulty to younger students, is postponed till near the end of the syllabus, and is then introduced merely as a convenient substitute for W/g. The word weight is explained to mean quantity of matter as determined by weighing it on an even balance scale (not on a spring balance). When W is so weighed, the London value of g is always used in finding $M = W/g$.

6. In teaching a class, after the preliminary study of the derivation of the equations is finished, I would put them on the blackboard and let them remain there for handy reference when solving problems. A great number of problems should be solved by the class.

I am aware that much of what I have written above will be considered rank heresy by many teachers of physics, but I submit that since in the past they have failed to teach dynamics in such a manner that the students can grasp the subject and use it in college, it is high time they changed their methods and try the method that was successfully used fifty years ago.

Wm. Kent

INFLUENCE OF OXYGEN ON THE VALUE OF COAL

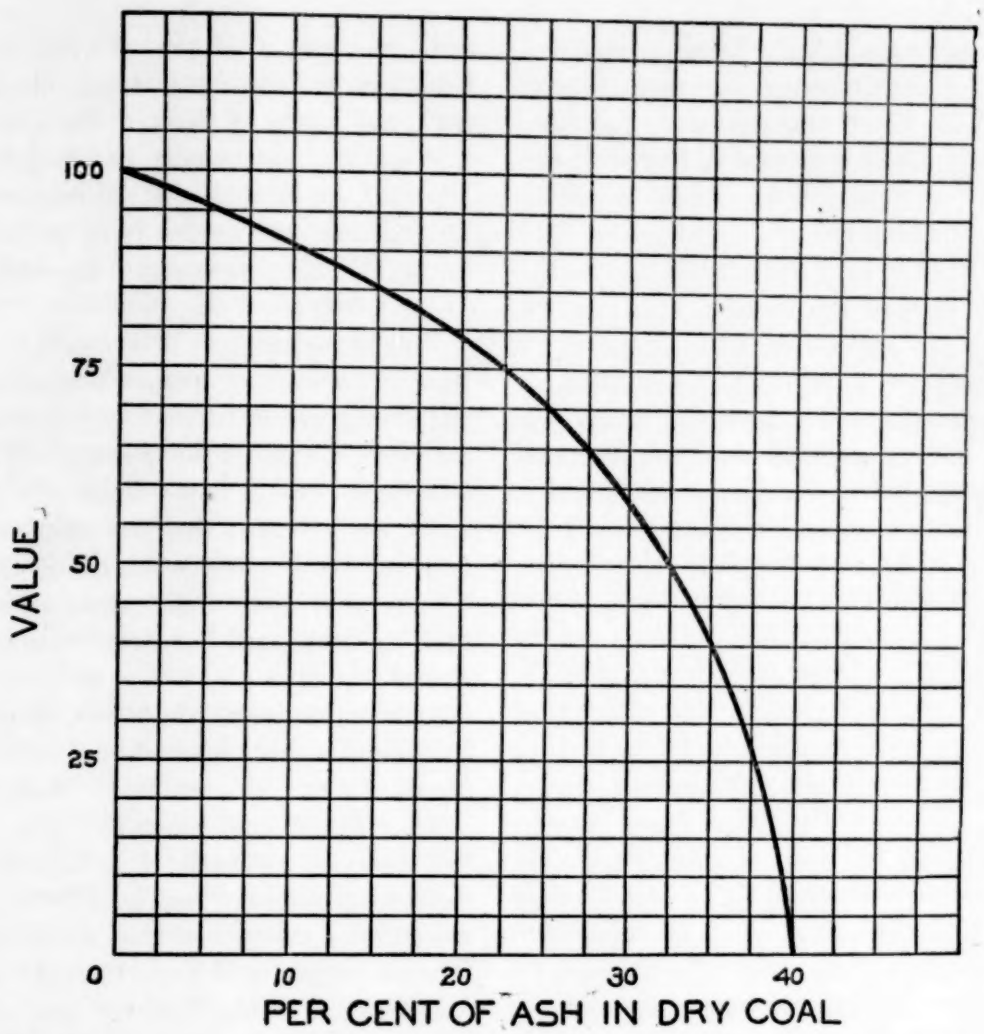
To the Editor of Science: Dr. David White, in Bulletin No. 382 of the United States Geological Survey, under the title of "Oxygen in Coal," has presented some interesting and valuable matter. There are certain features, however, which may profitably have more exact examinations.

Dr. White shows that the presence of oxygen in coal has an effect equal to that of ash in reducing the heating power value of the fuel; it is, of course, true that it displaces an amount of combustible matter equal to that of ash. There is some question, however, as to what is implied by the statement. As far as the combustion process is concerned, oxygen is present as a gas and aside from displacing a corresponding weight of combustible matter in the coal, its only harmful influence is in carrying away a small amount of heat in its exit to the chimney; while the presence of ash, on the other hand, has a very harmful influence on the result produced in combustion, because ash makes clinker and otherwise obstructs the fire.

W. L. Abbott[1] has shown in a well-conducted series of experiments that the value of fuel, for the purpose of making steam, drops to zero when the ash content is equal to 40 per cent., as shown by the accompanying diagram. Therefore, it appears that ash is enormously more harmful than oxygen, because if the latter was present to the extent of 40 per cent. the loss of heat from this cause would not exceed 6 or 7 per cent.

While particular emphasis has been placed upon the presence of oxygen as an element by Dr. White, I would prefer considering the matter from the standpoint of the total inert volatile matter instead of simply that of oxygen

[1] *Journal of the Western Society of Engineers*, Vol. XI., p. 529.



alone. The argument may be made clear by the two following tables:

ELEMENTS IN COAL

Combustible	*Non-combustible*
Carbon.	Oxygen.
Hydrogen.	Nitrogen.
Sulphur.	

COMPOSITION OF COAL

Combustible	*Non-combustible*
Carbon.	Water of combination.
Available hydrogen.	Nitrogen.
Sulphur.	

The first table presents a list of elements in coal and by this pure coal is meant, or, in other words, free from ash and moisture. In the second tabulation it will be observed that no oxygen is listed, but a new constituent water of combination takes its place. Our conception of the presence of oxygen in coal is that it is all in combination with hydrogen. The table also shows hydrogen which is available in combustion for heat production. Thus, when values are given upon this basis, the inert volatile matter which contains oxygen and hydrogen as water of combination, becomes a larger quantity than the oxygen figure which Dr. White has employed.

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ALLIGATOR MISSISSIPPIENSIS IN OKLAHOMA

THE occurrence of any species of reptile at a considerable distance beyond its usual or recorded range is a matter of general zoological interest. The capture of *Alligator mississippiensis* Daudin in central Oklahoma under circumstances which render it very improbable that the individual had ever been in captivity seems, therefore, worthy of record. The specimen was taken in a "lake" or bayou of the South Canadian River within five miles of the State University of Oklahoma, at Nor-

man. It was secured by a farmer, who presented it to the university museum through Dr. A. H. Van Vleet. Its skeleton has been preserved, and a life-like model, full size, was made and is now in the university museum. The specimen was a female, slightly over four and one half feet in length from tip to tip. It had been seen in the locality where taken, by a number of persons at various times for at least three years previous to its capture.

There is no record nor tradition of an alligator ever having escaped or been liberated (or even held captive) in this vicinity, and it is quite unlikely that such a thing could have occurred in what was formerly the Indian Territory. It seems altogether probable, therefore, that this individual had traveled up the Arkansas River to the mouth of the Canadian, and thence up the latter to the vicinity of Norman, some three hundred and fifty to four hundred miles west of the Arkansas-Oklahoma state line. The Canadian River is not a navigable stream and for most of the year is only a small meandering creek in a wide valley well filled up with sand. It is subject to numerous freshets, and frequently changes its course, so that "lakes" or bayous are numerous. The larger of such bayous apparently would make an admirable habitat for this species.

It is useless to speculate on the causes which impelled this individual to make such a journey, but it is important that it was apparently successfully maintaining its existence in its new station until man's interference put an end to one of nature's experiments.

H. H. Lane

State University of Oklahoma,
Norman, Okla.,
November 26, 1909

QUOTATIONS

PRESIDENT SCHURMAN AND THE FUTURE OF CORNELL UNIVERSITY

President Schurman is determined to put every department of Cornell University under the control of the Legislature at Albany. He has hinted such a purpose in the past, and now he makes it clear. The first title in his report to the Board of Trustees is "State Support and Control of the University." Under this heading the president indicates that he would welcome state control and shows how it may easily be brought about; he does not explain how state *support* may also be obtained, but leaves it to be inferred that he thinks the state will inevitably support what it controls.

The president has done well to bring this question into the open. The alumni of the university are entitled to a voice in deciding so vital a matter of policy. Will they be found to favor the president's plan? We think not. But if they are opposed to it they must make themselves heard, or the president will unquestionably take their silence for consent. The alumni have representatives on the Board of Trustees whose opinion they, presumably, can sway, but this question is too important to be debated and decided behind closed doors. It should be discussed in the open. There are difficulties and dangers in the university's path if it follows President Schurman on his road to Albany. Are there substantial rewards at the end of the journey? The university will hope to make the state its benefactor. But will it not put behind it for all time the hope of any substantial benefactions from private sources? Which road shall we take? This paper hopes to have an opportunity to print some opinions on the subject.—*Cornell Alumni News.*

SCIENTIFIC BOOKS

Life Histories of Northern Animals: An Account of the Mammals of Manitoba. By Ernest Thompson Seton, Naturalist to the Government of Manitoba. With 68 maps and 560 drawings by the author. New York, Charles Scribner's Sons. 1909. Two volumes, royal 8vo. Vol. I., Grass-eaters, pp. i–xxx, 1–673, pll. i–xlvi, text illust. 1–182 and maps 1–38. Vol. II., Flesh-eaters, pp. i–xii, 675–1267, pll. xlvii–c, text illust. 183–267 and maps 39–68. $18 net per set.

The secondary title of Mr. Seton's great work, "An Account of the Mammals of Manitoba," more definitely expresses its scope and character than the leading title, "Life Histor-

ies of Northern Animals," for the work deals almost exclusively with the mammals of Manitoba with such reference to those of North America at large as is required in the full treatment of species which in most instances have a wide North American range. Although the author has spent many years in Manitoba, and is thus an authority from first-hand knowledge on the mammals of this province, his studies of the species in life have been made in large part at localities remote from Manitoba—from the eastern United States, Colorado, New Mexico, Wyoming and California northward to Great Slave Lake. This is, of course, as it should be—an intimate acquaintance with the species of a local area supplemented by studies of the same species in their wider distribution. His life histories of the mammals of Manitoba are thus their life histories as species, with special reference to their representation in Manitoba.

The present work is notable in many ways, some thirteen hundred pages, one hundred plates, two hundred and sixty-seven text illustrations[1] and sixty-eight maps being employed to elucidate the history of sixty species. Each history may be characterized as an elaborate monograph of the habits and distribution of the species to which it relates. Technicalities are reduced to a minimum, and are introduced only so far as to give the current technical name of the species and its systematic relations; the descriptions are brief but accurately diagnostic, and, with the profuse illustrations, are sufficient for the identification of the species and to show its external characteristics.

Mr. Seton has long been known to those who have kept in touch with his work as an ardent and painstaking student of animal life, and also as a natural history draughtsman of rare ability. His fitness for the task here undertaken is thus evident alike in the text and in the illustrations.

A few words from the author's preface and introduction will serve to present his viewpoint and aim in preparing the work. He says:

[1] As numbered, but in many cases half a dozen or more figures are included under one number.

> This aims to be a book of popular Natural History on a strictly scientific basis. . . . Although I have limited the scope to the 60 species found in Manitoba, this takes in all the large land mammals of the United States, except about a dozen, including five of the big game. Having followed these 60 into all parts of their ranges, I have virtually included the Continent from Labrador to California. . . . Thirty years of personal observations are herein set forth; every known fact bearing on the habits of these animals has, so far as possible, been presented, and everything in my power has been done to make this a serious, painstaking, loving attempt to penetrate the intimate side of the animals' lives—the side that has so long been overlooked, because until lately we have persistently regarded wild things as mere living targets and have seen in them nothing but savage or timorous creatures, killing, or escaping being killed, quite forgetting that they have their homes, their mates, their problems and their sorrows—in short, a home-life that is their real life, and very often much larger and more important than that of which our hostile standpoint has given us such fleeting glimpses. . . . My theme is *the living animal*. . . .
>
> No one who believes in Evolution can doubt that man's mind, as well as his body, had its origin in the animals below him. Otherwise expressed, we may say that: Just as surely as we find among the wild animals the germs or beginnings of man's material make-up, so surely may we find there also the foundations and possibilities of what he has attained to in the world of mind. This thought lends new interest to the doings of animals in their home-life, and I have sought among these our lesser brethren for evidence of it—in the rudiments of speech, sign-language, musical sense, esthetics, amusements, home-making, social system, sanitation, wed-law, morals, personal and territorial property law, etc. . . . As much as possible I have kept my theories apart from my facts, in order that the reader may judge the former for himself.

In the introduction he further unfolds the plan of treatment, and states that each animal is considered "under some thirty different heads" or sections, but in very few cases are they all employed in connection with any one animal, their absence indicating that nothing is known respecting these particular points. Among those most commonly employed are:

tracks, speed, mind, environment, range, migrations, numbers, food, property, storage habit, sociability, means of communication, senses, amusements, nesting, homes, sanitation, training of the young, morality, enemies and disease, odd partnerships, commensalism, etc. These subtitles appear as side-headings in the text under the species, having been first defined and explained in the introduction.

To speak more in detail, the introduction is one of the most important parts of the book, beginning as it does with a Sketch of the Physical Features of Manitoba (pp. 1–11), followed by a section on The Faunal Areas and Life Zones of Canada (pp. 11–22), and a statement of the General Plan of Treatment for Each Species (pp. 22–34). Under the first section, treating of the geology and physical features, a map illustrates the distribution of the deciduous and coniferous forests, the sandhills and marshes of the province. The section devoted to faunal areas is illustrated by a faunal map of North America, excluding the tropics, the continent being divided into three primary regions, arctic, temperate and tropical, and these again into smaller areas designated as faunas and subfaunas. The lines of division are mainly in accord with those recognized by other recent authorities, corrected in certain details by the author's own researches, and with several new minor subdivisions. A diagram on page 21 shows the relationships of the zones and faunas of the temperate region, shaded to indicate the relative amount of rainfall in each. His two primary boundary lines, separating the temperate region respectively from the arctic and tropical, are the Arctic Circle and the Tropic of Cancer, the first being, roughly, the southern limit of perpetual frost in ground exposed to the direct rays of the sun, the other the line where frost ceases.

Under Plan of Treatment, each subtitle of the life history of a species is concisely defined. It is here said: "The environment is the creator of the animal, the mold in which each species was cast"—of course in the ultimate sense. "The range of the animal," he adds, "is part of its environment, and long ago I came to the conclusion that every animal is changing its range." That such is the case in Manitoba, with respect to several species, he brings forward indubitable evidence. Mr. Seton first became a resident of Manitoba in 1882, at which date certain species were entirely absent from the province which have since not only entered it, some from the southeast and some from the southwest, but have possessed themselves of considerable portions of its southern border. These are species which for the most part find in the opening up of new areas to agriculture favorable changes in environment.

The amount of space given to the different species varies in accordance with their importance and interest, or, perhaps more correctly, with the amount of information available respecting them. Thus some of the smaller rodents have as much space given to them as is given to the elk or wapiti, while still more is naturally given to the beaver. As an illustration of the method and fulness of treatment, the wapiti and pocket gopher may be cited. The account of the former occupies 30 pages, with a full-page plate of the animal, a full-page map showing its distribution and three full pages of figures illustrating the antlers (24 figures). The text gives first its names (English vernacular, technical, French Canadian and Indian); its family, generic and specific characters (the latter including measurements, weight, color); a list of the forms (subspecies) now recognized; a history of its early discovery and its early names, followed by the "life history," under the subheadings range, ancient numbers (estimated at 10,000,000), dwindling, in Manitoba, present number (estimated at 45,650 in 1907), signs, tracks (illustrated), wallows, dance, mating, antlers, record heads, the war-cry, pugnacity, the battle, the finish.

In the case of the pocket gopher, a full-page plate is given of the animal (life-size), a full-page map showing the range of the gopher family and a small map of the range of the northern pocket gopher in Manitoba; sketches of the fore and hind feet; life studies of the animal, showing numerous poses and attitudes in burrowing; a full-page and several other smaller diagrams of its burrows and tunnels under the snow, and others showing the fre-

quency of its mounds on given areas. The text and drawings are based partly on allied species inhabiting Colorado and California. Several pages of the text are devoted to its utility in making loam, and incidentally to showing the fallacy of Darwin's assumption that earthworms are found throughout the world, and are the chief agency in soil formation. Although in vast regions of the interior of North America there exists a stratum of humus, sometimes several feet in thickness, "earthworms are not native to any part of America south of the Great Slave Lake or west of the immediate Mississippi Valley," execept where they have been introduced.

This detailed, topical method of treatment is followed throughout the book, the illustrations varying with the character of the species treated, and include details of structure, poses of the animal, plans of runways, tracks, burrows, excrement (scatology), means of defense, etc.

The illustrations are usually the author's own, from sketches from life or from nature, the exceptions being usually skulls, which are mainly copied (with acknowledgments) from technical papers issued by the Biological Survey. The maps are the result of careful research, the ranges being compiled from the literature of the subject plus the author's personal information, the actual places of known capture being often indicated by dots within an admittedly hypothetical outline of the supposed range.

The author sticks closely to his text—the habits of the animals—to the exclusion of hunting stories and incidents of travel. Although the work is so voluminous the style is graphic and concise; the matter is pertinent and well stated, and there is no padding. There are some quotations from previous authors, some previously unpublished information from correspondents, credit for facts and data, published or unpublished, being bounteously given, but the great bulk of the matter is a record of the author's own observations and field explorations, carried on for a long series of years and over a wide range of country. As a contribution to the life histories of North American mammals it is without a rival, and beyond comparison the best work of its kind that has ever been written. Indeed, it is safe to say that nothing having the same scope and detail, either in text or illustrations, has ever before been attempted. These two ponderous volumes are a monument to the author's persistence and zeal through many long years of affectionate search for knowledge of the habits and intimate home life of our American mammals, to which the publishers have contributed a setting worthy of the subject.

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The Green Bug and its Natural Enemies. By Professor S. J. HUNTER. Bulletin of the University of Kansas, Vol. IX., No. 2.

This, the most voluminous study of the parasitism of a plant louse thus far reported, is worthy of careful attention. The rapid spread of the recently imported *Toxoptera graminum* from Europe is well presented and the illustrations of the structure of this and the related native species are quite satisfactory. The most useful parts of the work are the elaborate breeding experiments both on the plant louse and on its most abundant parasite *Lysiphlebus tritici.* Indeed, the publication affords the best data we have at hand for the discussion of the question of the efficiency of parasites. Not a little of the work is devoted to a defense of the author's claims as to the results of an aggressive campaign in which he distributed nearly 9,000 boxes of these parasites.

The author is very thoroughly convinced that the parasites were effective, saying (p. 8): "That this parasite not only controlled, but in many cases practically exterminated, the green bug last season, no one questions," and (p. 24): "Professor Glenn on the basis of twenty-five fold increase estimates that one female parasite placed with 2,000 adult green bugs just beginning to reproduce would exterminate them in twenty-five days, and one female with 10,000 such adults would exterminate them in thirty days."

The data presented hardly support the contention of the author, however, as will be shown below. He considers the parasite to belong particularly with this species of aphis, saying (p. 163): "It appears that *Lysiphlebus* does not perpetuate itself and maintain a general distribution on these other hosts," though it was first described from Missouri in 1888, and this particular plant louse was not recorded as far west as Indiana until 1890.

He recognizes the importance of weather conditions and states (p. 9): "The green bug continues to be active and reproductive at a lower temperature than does this parasite," thus giving the plant louse a start in the spring, and his assistant, Professor Glenn, says in the appendix on the "influence of climate," referring to the plant louse (p. 180), "it can not endure the high temperatures which prevail in summer," and in reference to the parasite (p. 182): "During the hot months of July and August, they decrease in numbers because of a lack of hosts, since the green bugs can not endure temperatures much above 100° F."

Since the aphid appears thus to have a lower optimum temperature it is most favorable to the parasite to compare the shortest period of development of each, which is for the aphid 5 days, for the parasite 7 days. Earlier in the year the intervals given are 11.5 and 17.69 days, respectively. The large amount of data make the average rate of reproduction appear to be very reliable and for the purpose of calculation we may use the round numbers 2 per day for twenty-five days for the aphis and 8 per day for five days for the parasite. This is favorable to the latter, the actual figures being a total of 59 and 38 descendants, respectively, for the summer condition. Three fourths of the parasites are counted female, though the actual number is only two thirds.

The following table gives the results of a calculation made by me and based on the figures given above.

In explanation of the table it may be said that only the large aphids are parasitized and nearly 85 per cent. are young insects when they are increasing at full capacity. Since one aphid produces 65,000 in 29 days and 95,000 in 30 days, the difference between these figures represents the descendants of the first two young insects and the ratio between these figures (68.5 per cent.) gives the reproductive power of the adult insect, which alone is liable to parasitization. The last column is obtained by dividing the figures showing egg-laying power by the number of adults (found by counting back five lines in the first column) and multiplying the quotient by the reproductive power of the adults. Thus the killing of 8 insects the second day affects the total of progeny the same as the killing of 5.92 on the first day, before the young had been produced. Adding the last column gives us the total result of the work of the parasite for any date within the month. The total for the month is 117.82. Had this number been killed the first day, the result on the total progeny would have been the same as that secured by killing over 700,000 plant lice and attaching the mummies of those dead plant lice to wheat stalks.

Day	Aphid		Parasite	
	Total	Reproducing Power of Adult	Egg-laying Power	Efficiency
1	1	100 %	8	8
2	3	68.5	8	5.92
3	5	47	8	3.76
4	7	32.2	8	2.57
5	9	22.8	8	1.82
6	11	15.7		
7	17	32.4		
8	27	37.5	48	3.5
9	41	37.2	96	5.5
10	59	32 5	144	5.15
11	81	26.9	192	4.7
12	115	28.5	240	4.2
13	169	31.1	192	2.05
14	251	31.7	144	1.11
15	369	31.8	384	2.1
16	531	31.1	908	3.8
17	761		1,727	4.7
18	1,099		2,876	5.36
19	1,601		4,336	5.4
20	2,339		5,200	4.42
21	3,401		5,488	3.24
22	4,933		6,952	3.19
23	7,131	31.4	11,258	3.22
24	10,333		20,162	3.92
25	15,011		36,266	4.9
26	21,813		61,418	5.69
27	30,657		90,314	5.76
28	44,907		117.794	5.18
29	65,561		149,162	4.53
30	95,571		199,454	4.17

The total effect of the parasite has scarcely more than 1 per cent. of the efficiency claimed for it in the publication under consideration, even though this is figured on a 40-fold increase instead of 25-fold. In every particular the assumptions upon which the above table is based are more favorable for the parasite than the experimental data presented by Mr. Hunter justify. And, moreover, the efficiency of the parasite does not increase by any such proportion as is generally assumed, the weekly averages only varying from each other by a small fraction, showing that years would have to elapse before the parasite would reach the efficiency supposed to be attained in twenty-five days or a month.

Of course, other factors enter into the problem, but the point that this calculation demonstrates is that these other factors are so much more important that, as compared with them, the work of the parasite is a negligible factor.

As corroborative evidence the author quotes Professor Marchal's account of the efficiency of the Australian ladybird against the cottony cushion scale. It may be instructive to state that during the last eighteen years this supposedly suppressed scale insect has figured as largely in the correspondence of the entomological department of the University of California as any scale existing in the state, and that on the university grounds and in the surrounding region it is now and has been all these years the most injurious scale insect present with the possible exception of the black scale.

Nearly all previous discussions of the efficiency of parasites or predaceous insects have been records of impressions instead of the presentation of experimental data. This author has accumulated a splendid lot of data, but has not used it. Like the others of us, he has been so impressed with the evidence he saw in the form of innumerable plant-louse mummies that he failed to grasp the importance of other conditions, probably largely meteorological, which might have caused the disappearance of the lice equally as soon had there been no parasites present. Aside from this one question of interpretation the work will be of great value to subsequent students of parasitism.

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Geology of the City of New York. By L. P. GRATACAP. Third edition. 8vo, pp. x + 232, 65 figs., 4 maps. New York, Henry Holt and Co. 1909. $2.50.

Gratacap's "Geology of the City of New York" was originally issued in 1901 as a pamphlet of 82 pages, specially designed for teachers of science, for pupils in the schools of the city and for the general reader to whom the metropolitan district furnished an attractive field of observation and study. The American Museum of Natural History conducts most commendable series of lectures for the teachers of the city and the manual found in them a constituency greatly needing just such a work. With the second edition the text was expanded to 119 pages, and now with the third the size of page is reduced from royal octavo to the more convenient octavo size and is expanded to embrace the latest results of study in the district. Practically a new book has been prepared.

The work opens with a general introduction intended to place the reader in command of the facts of stratigraphical classification, and, since the area is a metamorphic one, with the general principles and processes of this branch of geology. Manhattan Island is then described in detail; its topography, its rocks, its waterways, its minerals, etc. The boroughs of Brooklyn and Queens are next treated in a similar but much less detailed manner. Being covered with glacial drift throughout almost all of their area they furnish fewer rock exposures. The borough of the Bronx, although nearly as large as Manhattan and of similar formations, receives but a brief mention of four pages, and the borough of Richmond or Staten Island about four times as much. The evidences of glaciation in and about Greater New York are then taken up in the concluding pages.

The work contains a great deal of valuable record that will prove serviceable to engineers and contractors as well as to teachers and those with a popular interest in science. There

are historical details not easily attainable elsewhere. There is a valuable annotated list of minerals and an excellent bibliography. There is some need for the author to take greater care to attain a form of expression which may be grasped by those not necessarily widely read in the science. Unusual words such as fumic, salic, crenitic and the like might best be omitted. In the stratigraphical table, page 5, if Carboniferous is replaced by Carbonic, why not use also Cambric, Siluric, Devonic and Cretacic. In the treatment of the stratigraphy of Manhattan Island, it is far simpler and clearer to take up the Fordham gneiss, the Inwood limestone and the Manhattan schist, than to treat merely of gneiss, limestone and schist, with minor varieties. If, when a fourth edition is called for, the author will place himself in the attitude of a reader not of profound attainments in geology and, thus grasping his or her point of view, will put the facts of the local strata in simple and clear language, and will add an index, a work already serviceable and of value will be made still more so.

J. F. Kemp

An Elementary Treatment of the Theory of Spinning Tops and Gyroscopic Motion. By Harold Crabtree. Pp. xii + 140. New York, Longmans, Green & Co. 1909.

This is a very satisfactory book for one who wishes to gain a clear understanding of gyroscopic action. It contains a good discussion of Schlick's method of steadying vessels at sea and of Brennan's gyroscopic mechanism for balancing a monorail car.

The introductory chapter describes a number of curious and interesting forms of tops and gyroscopes. Chapter I. discusses rotation about a fixed axis, Chapter II. discusses precession and Chapter III. is a discussion of the phenomena described in the introductory chapter.

The starting of precession and gyroscope oscillations are discussed in Chapter IV., and the remainder of the book, Chapters V., VI., VII., VIII. and IX., discuss the more elaborate aspects of the theory of gyroscopic action.

The curious behavior of the stone implement known as the celt which is described on pages 7 and 54 may be observed with an ordinary pocket-knife with a rounded back. When such a knife is twirled on a smooth table the reaction of the table due to its vibratory motion causes its direction of spin to be reversed and if the knife is set rocking about a horizontal axis the reaction of the table due to the vibratory motion produces a slight spin about a vertical axis.

Altogether the book is a welcome and valuable addition to the literature of rotatory motion.

W. S. Franklin

SPECIAL ARTICLES

A SIMPLE CLOUD APPARATUS

The celebrated experiment on the production of clouds by C. T. R. Wilson forms an instructive lecture table demonstration. This need not necessarily be a difficult experiment. It is common observation that clouds of greater or less density are often seen upon the first few strokes of the pump when evacuating a vessel containing some moisture. The apparatus as Wilson constructed it was of necessity rather elaborate. That it may be of exceedingly simple and inexpensive construction and yet capable of giving quantitative results of a fair degree of accuracy is the object of this paper.

The apparatus consists of a glass bulb having two openings. To one, the larger, is attached a stiff rubber bulb, to the other a nipple for the introduction of the gases, etc., to be investigated. For qualitative results the glass vessel is blown in the form of a hooded bulb *B*, as shown in Fig. 1. This bulb should have a volume of about 75 c.c., while the hand bulb *HB* may be the stiff bulb that comes with an hydrometer syringe for testing electrolytes. The volume of this bulb should be about 250 c.c. The nipple *n* is closed by a rubber tube and a screw pinch-cock at *p*. It is well to insert a short glass tube extension beyond *p*. To operate, draw into the bulb *B* two or three cubic centimeters of water. This will be caught by the annulus or trough in *B*, thus keeping the gas in the bulb in contact with

water and hence more or less completely saturated. Close pinch-cock at *p* firmly. Now by compressing *HB* moderately and then releasing suddenly a dense cloud, in general, will be formed in *B*.[1] Repeated compressions and expansions will bring down clouds of rapidly diminishing densities. The bulb *B* will be

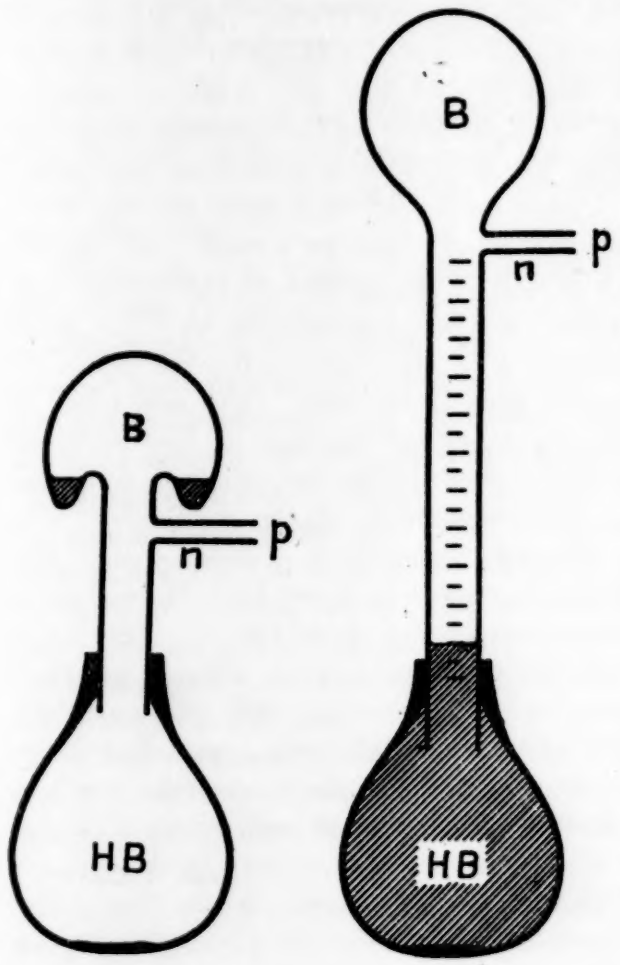

Fig. 1.

Fig. 2.

freed of dust particles by about the tenth expansion—depending upon the dustiness of the air originally drawn into the apparatus. Having freed the condensing chamber of dust particles, a dense cloud can again be formed by compressing the bulb firmly and then releasing. In this instance the expansion—*i. e.*, the ratio of the final to the initial volume of the gas—is greater than the critical value which for dust-free air is about 1.30.

The apparatus is now ready for the performance of a number of interesting and striking experiments. The formation of a single drop in the expansion chamber is not an uncommon sight. As is well known when the drops are few they are of large size and fall rapidly, while dense clouds formed in dust-laden air, or in dust-free air exposed to an ionizing agent, are composed of small drops, exhibit color effects and often may be quite opaque. This cloud settles slowly. The effect of dust is shown in a marked way by drawing into *B* a whiff of air laden with chalk dust. An exceedingly opaque cloud is obtained by presenting the nipple *n* to a burning match and drawing in some of the particles of carbon. It requires some twenty or thirty expansions to free the bulb of these particles. Dense clouds are formed by drawing in the gases through which an electric discharge is passing. The ionized air from the active side of a Roentgen ray bulb gives a marked effect. These cloud effects can be projected readily on a screen.

TABLE I

Critical Expansion in Dust-free Air

Zero	Upper Reading	Ratio	Cloud Effect
65	55	1.18	None.
65	54	1.20	None.
65	53	1.22	None.
65	52	1.25	None.
65	51	1.27	None.
65	50	1.30	A few dozen drops.
65	49	1.33	A dense cloud.
65	48	1.35	The same.
65	47	1.38	Very dense.

For quantitative results the apparatus is modified slightly. The trough in *B* may be omitted. The tube *T* should be 20 to 25 cm. long and graduated in cubic centimeters as shown in Fig. 2. The hand bulb *HB* and the tube *T* are filled with water to some convenient zero on the graduation. To operate, compress *HB* sufficiently to give the desired ratio on expansion. The free water column acts as an index and its proximity to *B* insures saturation. It is imperative that the walls of *HB* be of double or treble strength, otherwise the bulb on release will expand beyond the set zero. For individual observation the bulb *B*

[1] J. J. Thomson's "Conduction of Electricity through Gases," p. 167.

should be placed in front of a dead black screen and illuminated by a shielded lamp. A reading glass will aid considerably in observing the formation of the drops.

First determine the critical ratio, *i. e.*, the expansion at which drops just begin to form in dust-free air. Now produce expansions of gradually increasing amounts and note the cloud effects. A typical series is given in Table I.

As Thomson pointed out, after once drops have been formed in dust-free air they will form for some time after for expansions less than the critical value. Hence before another series is taken the bulb *HB* should be worked for moderate expansions to free the bulb *B* of nuclei. In Table II. are recorded two observations taken from each of ten different series similar to that given in Table I. The first observation, the critical expansion, is when drops first appeared, and the second is the next succeeding observation. This is recorded in the table to show how rapidly, yet uniformly, the drops increase by a slight increase in the expansion.

TABLE II

Critical Expansion in Dust-free Air

Tube	Zero	Upper Reading	Ratio	Cloud Effects
1	76	58	1.31*	A few large drops.
		57	1.33	A few hundred.
1	75	57	1.31*	Quite a cloud—large drops.
		56.5	1.33	A dense cloud.
1	76	58	1.31*	Just a few drops.
		57.5	1.32	About 50 drops.
2	65	50	1.30*	A few dozen drops.
		49	1.33	A dense cloud.
1	71	54	1.31*	A few dozen drops.
		53	1.34	A dense cloud.
2	65	50	1.30*	A few dozen.
		49.5	1.31	A dense cloud.
1	77	58.5	1.32*	A few drops.
		58	1.33	A few hundred.
1	77	58	1.33*	A few dozen.
		57.5	1.34	A few hundred.
1	77	58.5	1.32*	A few drops.
		58	1.33	A few hundred.
1	77	58.5	1.32*	A few drops.
		58	1.33	A few hundred.

Average of those marked (*) 1.31.

The average value of the critical ratio is 1.31. It should be noticed that the greatest variation from this mean is only 1.5 per cent. —a rather close agreement when we consider that the observations were made with two different tubes, and also that they extended over three or four weeks.

It was shown by Wilson that an ionizing agent is an important factor in the formation of drops in dust-free air. Various agencies, such as light from an incandescent lamp filament, the radiation from radium, the Roentgen rays, etc., were tried, each showing a decided effect. On placing a small glass capsule containing 10 milligrams of radium bromide of 200,000 activity within the bulb *B* a mean value of 1.27 was obtained for the expansion necessary to form drops. Care was taken to free the expansion chamber of dust particles, also to correct for the change in volume caused by the introduction of the small glass tube containing the radium. Again, with this simple apparatus it is not difficult to compare quantitatively the electrification when air is agitated with pure water, with a saturated common salt solution, and with mercury. The effects were all quite marked and the values obtained for the expansions could be repeated consistently at will.

Chas. T. Knipp

University of Illinois

System of Basketry Technic

Only in recent years have anthropologists interested themselves so generally in the industrial arts of primitive peoples. With this awakening interest has come the appreciation of the prominent place occupied by the cruder forms of weaving—namely, basketry—in the domestic economy of these simple households. It has assisted in the sheltering, the clothing and the feeding of tribes in many parts of the world. This wide distribution of locality, as well as that of usefulness, enables one to better understand the multiplicity of technics which are constructed of materials from so many climes, and in a manner to fit such a diversity of use. With the aggregation of

technics comes the necessity of uniformity in classification and terminology—that confusion may be avoided, and investigations be so recorded as to make possible scientific deductions, relationships of technics—and possibly of peoples.

The accompanying key to basketry, though in condensed form, is presented here with the thought that it may prove as helpful to the ethnologist unfamiliar with the work, as it has to the writer in serious study of collections from many parts of the world. An enlarged issue, fully explained and amplified, will appear later.

Acknowledgment must be made to the two authors who have previously treated basketry classification—Otis T. Mason and J. Lehmann—whose works have made it possible to take a step in advance, and record in clearer and more definite form this key to the technic.

The classification recognizes three kinds of basketry—plaited, woven and coiled ware, the division being based upon their construction or building process, as the elements plait, weave and coil. The fundamental process of the three distinct technics is easily discerned upon slight examination.

Plaiting constructs a mat-like surface by means of active elements only, which move over and under each other in regular order. No passive foundation elements are incorporated, neither are new elements added after the completion of the base, as those already furnished continue to plait the body of the basket.

Weaving is known by its upright warps extending from base to upper edge, as the surface is constructed on these passive warps, crossed by an active binding element, or weft. Two types of weaving—checked and twilled wicker—are less easily recognized because of the equal size of the warp and weft, but even here the distinct weft element added at the base may be traced encircling the basket.

Coiling can easily be distinguished by the spiral movement of its elements. This consists either of an active element, or of a passive element bound down by an accompanying active element.

This key approaches Mason's classification nearest at types of weaving, although here there are differences. Mason entirely excludes plaiting as a basketry process, while his types of coiled ware are based upon the components of the internal element—the foundations. The composition of the inner element is the last consideration, and a later division than is shown on this condensed key.

KEY TO BASKETRY TECHNIC

I. *Plaiting of Crossed Active Elements*

A. Parallel elements in two directions.
  1. Over and under one ..... Checked Plaiting.
  2. Over and under more than one, Twilled Plaiting.

B. Parallel elements in more than two directions, Lattice Plaiting.

II. *Weaving of Active Across Passive Elements*[1]

A. Parallel warps in one direction.
  1. Weft interlaced ..... Wicker Weave.
    a. Warps coarser than weft, Plain Wicker Weave.
    b. Warps of same size as weft.
      a'. Over and under one, Checked Wicker Weave.
      b'. Over and under more than one, Twilled Wicker Weave.
  2. Weft twined.
    a. Weft of two strands.
      a'. Over one warp .... Plain Twine Weave.
      b'. Over two warps . Twilled Twine Weave.
    b. Weft of three strands.
      a'. Plain weft .... Three-ply Twine Weave.
      b'. Braided weft, Braid Three-ply Twine Weave.
  3. Weft wrapped ..... Wrapped Weave.

B. Parallel warps in more than one direction.
  1. Weft interlaced .... Lattice Wicker Weave.
  2. Weft twined.
    a. Warps oblique, Oblique Lattice Twine Weave.
    b. Warps vertical and horizontal, Vertical Lattice Twine Weave.
  3. Weft wrapped .... Lattice Wrapped Weave.

III. *Coiling of Active Element or of Active Along Passive Element*

A. Active element only.
  1. Weft spiral ..... Spiral Lace Coil.
  2. Weft twisting ..... Twisted Lace Coil.
  3. Weft interlacing ..... Interlaced Lace Coil.

[1] Active elements are weft. Passive elements warp.

4. Weft knotting ..... Knotted Lace Coil.

B. Active and passive elements.

1. Weft spiral ..... Twisted Coil.
2. Weft twisting ..... Twisted Coil.
3. Weft interlacing ..... Interlaced Coil.
4. Weft looping ..... Looped Coil.

Mary Lois Kissell
American Museum of Natural History

FUSARIUM WILT OF CABBAGE

Wilt or "yellows" disease of cabbage, due to an undescribed species of *Fusarium,* has been known in this department for some years, as a trouble of minor importance, but it is now gaining such headway in some cabbage sections that active measures will have to be taken to combat it.

Some of the important symptoms are: retarded growth, wilting of the foliage, yellowing and dropping of the lower leaves. Later the upper leaves are affected and drop off, leaving the stem bare. In some cases one half of the leaf turns yellow while the other half retains its normal green color for a time. Microconidia are present in great numbers in the water-carrying vessels of the living plant. Soon after the death of the plant, pinkish masses composed of macroconidia form abundantly on the surface.

This disease was first observed by Dr. Erwin F. Smith in 1895. Experiments made by him in 1899 point to the soil as the source of infection. In 1900 Mr. W. A. Orton, of the U. S. Department of Agriculture, made field observations on the disease in South Carolina, and isolated the fungus, but did not carry on further work.

In April, 1908, the writer isolated the fungus from some material sent in from the south. During the past summer the disease has been reported from several states. In the kraut district of northern Ohio it has been very destructive.

Pot experiments were started in one of the greenhouses, to determine the parasitism of the fungus. After the cabbage plants had been growing in the pots for about ten days, pure cultures of the fungus were mixed into the soil, care being exercised not to injure the rootlets. In about three weeks some of the plants began to show symptoms of the disease. An examination of the plants a little later showed 83 per cent. of successful inoculations. None of the controls contracted the disease. The fungus was again recovered from one of the diseased plants, fresh soil was secured, young plants set out and inoculated as in the previous case with pure cultures of the *Fusarium* isolated from one of the previously inoculated plants. The greenhouse conditions for these later experiments were very unfavorable, but a fair percentage of the inoculations were successful. The controls did not contract the disease. This disease will be studied further.

L. L. Harter
Bureau of Plant Industry,
U. S. Department of Agriculture

THE SEPARATED BLASTOMERES OF CENTRIFUGED EGGS OF ARBACIA

In recent years embryologists have been attempting to find out the rôle in development played by the visible materials of the egg (pigment, yolk, oil, etc.); whether they are organ-forming materials or merely passive inclusions. By no means has a uniform conclusion been reached.

In the eggs of *Arbacia,* the experiments of Lyon and Morgan show that the visible substances, by means of the centrifuge, can be thrown into any part of the egg without affecting in any way the embryonic development up to the pluteus. The simple experiment which I wish to record adds further proof that the visible substances in this particular egg are not organ-forming materials. Driesch and Morgan have shown that the one half, one fourth, one eighth and one sixteenth blastomeres of the sea-urchin egg are capable of developing into normal but smaller plutei. Lyon further showed in the centrifuged eggs of *Arbacia* that the visible substances separate readily into four distinct layers and that the first cleavage is nearly always at right angles to the stratification, but some few are parallel to it. The purpose of my experiment was to take those centrifuged eggs in which the first division plane was parallel to the stratification, separate the first two blastomeres and see

whether they would develop into normal plutei.

The eggs were first centrifuged and then fertilized. About one minute after fertilization the membrane was shaken off and the eggs transferred to calcium-free sea-water (Herbst's formula). They were allowed to segment in the calcium-free sea-water and some of the eggs in which the first cleavage plane was parallel to the stratification were isolated. After the blastomeres had fallen apart, they were transferred to normal sea-water where they were permitted to develop. The two blastomeres thus produced differ in that one contains all the red pigment while the other one is perfectly clear and contains the whole of the oil cap. The exact distribution of the two middle layers is not easily made out. Both blastomeres produce normal plutei. The only visible difference in the two was that one contained the red pigment-spots; the other lacked them.

FERNANDUS PAYNE
INDIANA UNIVERSITY

THE CONVOCATION WEEK MEETINGS OF SCIENTIFIC SOCIETIES

THE American Association for the Advancement of Science and the national scientific societies named below will meet at Boston, Mass., during convocation week, beginning on December 27, 1909.

American Association for the Advancement of Science.—Retiring president, Professor T. C. Chamberlin, University of Chicago; president, Dr. David Starr Jordan, of Stanford University; permanent secretary, Dr. L. O. Howard, Cosmos Club, Washington, D. C.; general secretary, Professor Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

Local Executive Committee.—H. W. Tyler, chairman; Thomas Barbour, J. S. Kingsley, Edward R. Warren, John Warren, George W. Swett, secretary.

Section A, Mathematics and Astronomy.—Vice-president, Professor Ernest W. Brown, Yale University; secretary, Professor G. A. Miller, University of Illinois, Urbana, Illinois.

Section B, Physics.—Vice-president, Dr. Louis A. Bauer, Carnegie Institution, Washington, D. C.; secretary, Professor A. D. Cole, Vassar College, Poughkeepsie, N. Y.

Section C, Chemistry.—Vice-president, Professor William McPherson, Ohio State University; secretary, C. H. Herty, University of North Carolina, Chapel Hill, N. C.

Section D, Mechanical Science and Engineering.—Vice-president, Professor John F. Hayford, Northwestern University; secretary, G. W. Bissell, Michigan Agricultural College, East Lansing, Mich.

Section E, Geology and Geography.—Vice-president, Reginald W. Brock, Canadian Geological Survey; secretary, F. P. Gulliver, Norwich, Conn.

Section F, Zoology.—Vice-president, Professor William E. Ritter, La Jolla, Cal.; secretary, Professor Morris A. Bigelow, Columbia University, New York City.

Section G, Botany.—Vice-president, Professor David Penhallow, McGill University; secretary, Professor H. C. Cowles, University of Chicago, Chicago, Ill.

Section H, Anthropology.—Vice-president, Dr. W. H. Holmes, Bureau of American Ethnology; secretary, Dr. George Grant MacCurdy, Yale University, New Haven, Conn.

Section I, Social and Economic Science.—Vice-president, Byron W. Holt, 54 Broad St., New York City; secretary, Dr. John Franklin Crowell, 44 Broad St., New York City.

Section K, Physiology and Experimental Medicine.—Vice-president, Professor C. S. Minot, Harvard Medical School; secretary, Dr. Wm. J. Gies, College of Physicians and Surgeons, Columbia University, New York City.

Section L, Education.—Vice-president, Dean James E. Russell, Columbia University; secretary, Professor C. R. Mann, University of Chicago, Chicago, Ill.

The American Society of Naturalists.—December 29. President, Professor T. H. Morgan, Columbia University; secretary, Dr. H. McE. Knower, University of Toronto, Toronto, Can. *Central Branch.* President, Professor R. A. Harper, University of Wisconsin; secretary, Professor Thomas G. Lee, University of Minnesota, Minneapolis, Minn.

The American Mathematical Society.—December 28–30. President, Professor Maxime Bôcher, Harvard University; secretary, Professor F. N. Cole, 501 West 116th St., New York City.

American Federation of Teachers of the Mathematical and Natural Sciences.—December 27, 28. President, Professor H. W. Tyler, Massachusetts Institute of Technology; secretary, Professor C.

R. Mann, the University of Chicago, Chicago, Ill.

The American Physical Society.—President, Professor Henry Crew, Northwestern University; secretary, Professor Ernest Merritt, Cornell University, Ithaca, N. Y.

The American Chemical Society.—December 27–31. President, Dr. Willis R. Whitney, General Electric Company, Schenectady, N. Y.; secretary, Professor Charles L. Parsons, New Hampshire College, Durham, N. H.

The Geological Society of America.—December 29, 31. President, Dr. G. K. Gilbert, U. S. Geological Survey; secretary, Dr. E. O. Hovey, American Museum of Natural History, New York City.

The Association of American Geographers.—December 30–January 1. President, Professor W. M. Davis, Harvard University; secretary, Professor Albert P. Brigham, Colgate University, Hamilton, N. Y.

The American Society of Vertebrate Paleontologists.—December 27–29. President, Dr. J. C. Merriam, University of California; secretary, Dr. E. S. Riggs, Field Museum of Natural History, Chicago, Ill.

The American Society of Biological Chemists.—December 28–30. President, Professor Otto Folin, Harvard Medical School; secretary, Professor William J. Gies, 437 West 59th St., New York City.

The American Physiological Society.—December 28–30. President, Professor W. H. Howell, Johns Hopkins University; secretary, Dr. Reid Hunt, Hygienic Laboratory, 25th and E Sts., N. W., Washington, D. C.

The Association of American Anatomists.—December 28–30. President, Professor J. Playfair McMurrich, University of Toronto; secretary, Professor G. Carl Huber, 1330 Hill St., Ann Arbor, Mich.

The Society of American Bacteriologists.—December 28–30. President, Dr. J. J. Kinyoun, Washington, D. C.; secretary, Dr. Norman MacL. Harris, University of Chicago, Chicago, Ill.

The American Society of Zoologists.—Eastern Branch, December 28–30. President, Professor Herbert S. Jennings, Johns Hopkins University; secretary, Dr. Lorande Loss Woodruff, Yale University, New Haven, Conn.

The Entomological Society of America.—December 29, 30. President, Dr. Henry Skinner, Philadelphia, Pa.; secretary, J. Chester Bradley, Cornell University, Ithaca, N. Y.

The Association of Economic Entomologists.—December 28, 29. President, Professor W. E. Britton, Connecticut Agricultural College; secretary, A. F. Burgess, U. S. Department of Agriculture, Washington, D. C.

The Botanical Society of America.—December 28–31. President, Professor Roland Thaxter, Harvard University; secretary, Professor D. S. Johnson, Johns Hopkins University, Baltimore, Md.

American Nature Study Society.—January 1. President, Professor C. F. Hodge, Clark University; secretary, Professor M. A. Bigelow, Teachers College, Columbia University, New York City.

Sullivant Moss Society.—December 30. President, Professor Bruce Fink, Miami University, Oxford, O.; secretary, Mrs. Annie Morrill Smith, 78 Orange St., Brooklyn, N. Y.

Wild Flower Preservation Society.—President, Professor Chas. E. Bessey; secretary, Dr. Charles Louis Pollard, New Brighton, N. Y.

The American Psychological Association.—December 29–31. President, Professor Charles H. Judd, University of Chicago; secretary, Professor A. H. Pierce, Smith College, Northampton, Mass.

The American Anthropological Association.—December 27–January 1. President, Dr. W. H. Holmes, Bureau of Ethnology; secretary, Dr. Geo. Grant MacCurdy, Yale University, New Haven, Conn.

The American Folk-lore Society.—Week of December 30. President, Dr. John R. Swanton, Bureau of American Ethnology; acting secretary, Dr. R. B. Dixon, Peabody Museum, Cambridge, Mass.

Association of Mathematical Teachers in New England.—December 28. President, Charles A. Hobbs, Watertown, Mass.; secretary, George W. Evans, Charlestown High School, Boston, Mass.

Physics Teachers of Washington, D. C.—Meets in conjunction with American Federation of Teachers. President, W. A. Hedrick, McKinley High School, Washington, D. C.; secretary, Dr. Howard L. Hodgkins, George Washington University, Washington, D. C.

American Phytopathological Society.—December 28–30. President, Dr. L. R. Jones, University of Vermont; secretary, Dr. C. L. Shear, U. S. Department of Agriculture, Washington, D. C.

American Alpine Club.—December 30. Secretary, Dr. Henry G. Bryant, Room 806 Land Title Building, Philadelphia, Pa.

American Breeders' Association.—Meeting of Eugenics Committee. Secretary, Dr. Chas. B. Davenport, Cold Spring Harbor, N. Y.